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A TECHNIQUE TO ASSESS THE WORTH OF INVENTORY ACCOUNTING SYSTEMS--ETC(U)
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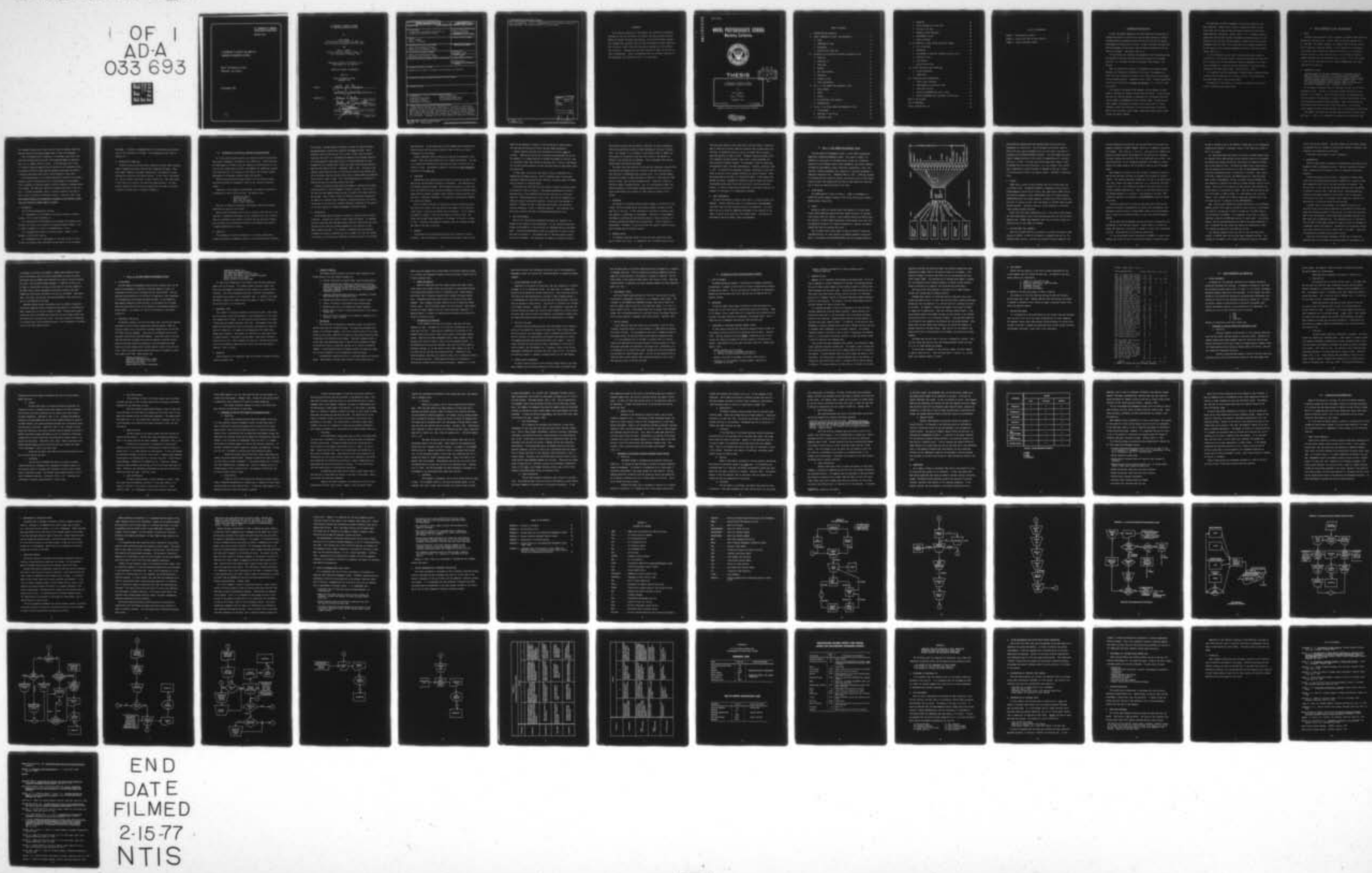

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A TECHNIQUE TO ASSESS THE WORTH OF INVENTORY ACCOUNTING SYSTEMS

NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA

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A TECHNIQUE TO ASSESS THE WORTH
OF INVENTORY ACCOUNTING SYSTEMS

by

Lee D. Mabee
Pacific Missile Test Center, Pt. Mugu, CA
B.S., University of Southern California, 1960

and

Urban J. Toucher
Pacific Missile Test Center, Pt. Mugu, CA
B.S., University of Wyoming, 1959

Submitted in partial fulfillment of the
requirements for the degree of

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September 1976

Authors Lee D. Mabee
Urban J. Toucher

Approved by James O. Jolly
Thesis Advisor

John W. Creighton
Thesis Advisor

Carl R. Jones
Chairman, Department of Adminstrative Sciences

J. R. Borsting
Academic Dean

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This thesis contains an assessment of inventory accounting systems in use by the Navy, Air Force, and the private sector. Based on review of eight attributes, the private sector system was judged near optimum, the Air Force system as barely meeting the criteria, while the Navy system was judged as not meeting the criteria. Changes for the Navy system to meet the criteria

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NAVAL POSTGRADUATE SCHOOL

Monterey, California

THESIS

A TECHNIQUE TO ASSESS THE WORTH
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and
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I. INTRODUCTION AND OBJECTIVE

In 1972, the Deputy Comptroller for Audit Operations (Directorate for Interservice Audits) of the Office of the Assistant Secretary of Defense (Systems Analysis) conducted an audit of the air-to-air missile support requirements of the Navy and Air Force. In part, the audit disclosed that "Better management of and control over the missiles possessed by the two Services is needed." (DoD Audit, 1973, p. 2).

This disclosure was reinforced by responses to the following questions: How accurate is the Navy inventory accounting system for air-launched missiles? Is it accurate to within one percent, three percent, five percent?

When this question was asked of air-launched missile weapon systems managers, the response was unanimous; no one knew. The managers only knew it was very inaccurate, and that it did little to assist the manager in his planning function. (Ledbetter, Wilson, 1976). The most predominate criticism was the failure to account for material, i.e., a lack of inventory control.

For inventory and weapon system managers, correct answers to these types of questions are essential to good decision making. In the military services, an inventory manager is responsible for an equitable distribution of assets to accommodate various strategic needs. For obvious economic reasons, the quantity of assets he has to work with is limited. Therefore, within the constraints of the available assets, he must be able to both distribute, and at times, redistribute these assets to meet routine and special demands.

The importance of special management for high-value items has long been recognized. However, until recently, accounting control of high-value assets has not been alloted the attention required to effectively manage expensive inventories. (Brock, 1964, p. ii). Extremely expensive, complex and sophisticated inventory management systems have been less than impressive, and much less than satisfactory, because of the lack of asset knowledge used as an input. Valid asset data is an absolute prerequisite for the success of any inventory management system for high-value material. (Brock, 1964, p. 2).

It is a well-known fact that one of the most complicated systems in the military is the inventory system. One cannot exaggerate the importance of an inventory to a military operation since the readiness of any fighting unit depends in a large part on the availability of the basic weapon, spare parts and other support items. (Schrady, 1972, p. 339).

It is apparent then that development of sophisticated, automated systems to provide asset accountability is useful, but only if they provide the type data needed and in the accuracy needed.

The objective of this thesis is to develop a technique to assess the worth of inventory accounting systems.

II. SCOPE, IMPORTANCE OF STUDY, AND METHODOLOGY

A. SCOPE

Inventory studies generally focus on aspects of economic order quantities, forecasting, lost sales, etc. (Buffa, 1969, pp. 503-534, Schrady, 1972, pp. 339-383). This thesis, however, will concern itself with the accountability aspects of inventory systems. It will primarially be concerned with systems used to control and record the distribution of air-launched missiles for the U. S. Navy and Air Force. It will attempt to develop needed techniques and make preliminary tests of them. It will not attempt to carry out full scale tests, but will make recommendations for needed continuation and testing.

B. IMPORTANCE OF STUDY

> Inventory reports of the major components of air-launched missiles need to be more accurate for use in current inventory management and future inventory planning. We found differences between missile inventory balances reported under the formal inventory control system and those reported under a special monthly inventory report. . . . Our review disclosed that neither inventory report was sufficiently accurate for management's use. (DoD Audit, 1973, p. 3).

As an example of problems caused by imbalance, consider the following hypothetical cases: Let the U. S. Navy have fifteen thousand air-to-air missiles in its inventory. Also, let the price per unit average $25,000. Then, the value of the inventory is 15,000 x 25,000 or $375,000,000, excluding spare parts and special support equipment. Now, let the accuracy of the inventory count vary by plus or minus ten percent. The value now varies between $337,500,000 and $412,500,000, or a difference of $75,000,000.

The example illustrates the high waste resulting from inaccurate inventory count. In fact, it is reasonable to assume that if one believes that

the inventory figures are in error, one will tend to overbuy rather than take the chance of not having enough assets in case of an emergency.

The air-launched missile inventory is of extremely high value. One need only to peruse the Fiscal Year 1977 Authorized Budget to determine this. (U. S. Senate, 1976, pp. 42-43). It follows then, that if the U. S. Navy is going to spend millions of dollars on air-launched missiles, it should be willing to spend some percentage of that amount to develop a system to accurately keep track of those high-dollar value items.

In private business, it is normally desirable to maintain an inventory posture as small as possible while still being capable to meet demands. This is necessary to keep the number of dollars invested in unneeded assets at a minimum. The same logic applies to inventory quantities in the military. In either enviornment, there is one basic necessity that must be met in order to minimize the inventory quantity. That basic need is <u>for the inventory manager to be adequately informed as to the quantity, condition, and location of assets under his control</u>.

C. METHODOLOGY

The following methodology was pursued:

(1) Development of an instrument to be used in assessing inventory systems. This is found in Chapter III.

(2) Description of three systems to be assessed; the systems used by the Navy, Air Force, and a private firm, Matson Navigation Company. This is found in Chapters IV, V and VI, and Appendixes B, C and D.

(3) Assessment and rating of the three systems. Chapter VII and Appendix E perform this function.

(4) Recommendations for improvements for the Navy system to allow it to meet Navy Managers needs based upon the application of the instrument

developed. In addition, recommendations for further testing and possible uses of the instrument will be made. The recommendations are found in Chapter VIII.

D. DEFINITION OF TERMS USED

In both military and private sector operations, persons tend to develop special language tools which simplify their communication needs. These tools appear commonly as acronyms, abbreviations, and especially coined expressions to describe a particular process. In this thesis, the authors will use the "terms of the trade" in their natural role. The normal words of the trade will be used to facilitate the reading process. For some persons reading this thesis who may be unfamiliar with some of the terms, a glossary of terms used is included as Appendix A.

III. ATTRIBUTES OF AN EFFECTIVE INVENTORY ACCOUNTING SYSTEM

As in any other accounting system, an inventory accounting system must have certain fundamental attributes to work effectively. These attributes are highlighted to provide a basis for judging the relative merits of various "in-use" systems and to provide a springboard for suggesting a system for future Navy use. For purposes of this thesis, the inventory systems evaluated will be perpetual systems rather than periodic.

Before discussing the attributes essential for an effective system, one should consider the fundamental intent of any inventory accounting system.

Regardless of the commodity being managed, the essential questions to be answered are nearly always the same. The questions are:

How many are there?
Where are they?
Which ones are where?
What is their condition?

How well an inventory accounting system answers these four questions determines the quality of the system.

Many of these attributes will be seen to relate to more than one of the questions. Although the attributes are not considered to be all inclusive, they are considered by the authors to contain the most important elements. Each attribute will be discussed individually and examples given where it is deemed appropriate for clarity.

A. SIMPLICITY

This element was listed first because it is so often ignored when accounting systems are assembled, especially in applications where computers

are involved. Systems should be designed to answer the questions asked, and not designed to answer every question that might be asked. While additional types of data may be "nice to have," unless they are clearly required, they tend to (1) overburden the manager with extraneous data and (2) create potential areas where errors or misinterpretations can occur. Systems which are "generalized" to meet the needs of many persons generally meet the real needs of no one. (Alexander, 1975, p. 99). The user of the system's output should be able to visualize the source of the derived data while the person entering the data should have an understanding and appreciation of how his input is used. This latter understanding is necessary to develop the desire to provide accurate input data.

Inventory accounting systems should be capable of standing alone rather than being part of a total management information system. This is not to say that the same computer cannot be used, nor some of the inputs would not be the same. What is meant is that the inventory accounting system would be capable of accepting input information, processing the data, and providing answers to the four basic inventory questions, regardless of the action of the other aspects of a general management information system.

B. ACCESSIBILITY

While systems need the element of simplicity, they also must be easily accessible. Accessibility refers to both inputs and outputs. In considering that inputs may come from many sources, one must realize that the input function may be radically different depending on the authority of the agency entering the data. For instance, a gatekeeper may be authorized to update the system by recording the serial number of an item that appears at the gate, but he may not be authorized to correct an error in the system

made previously. On the other hand, the item manager may be authorized to correct errors, override existing data and input virtually any type of information into the system.

Output information from an accounting system may be channeled to many sources. Often the output reports are of a limited distribution. The idea is to provide the information for each data user that is helpful to him--no more, no less. The essential element is to have the right information available at the right time.

C. TIMELINESS

Knowing what your checking account balance was one year ago does little good unless you have made no deposits or withdrawals. The same applies to an inventory accounting system. While knowing the quantity on hand, location, and condition one year ago may be adequate on some slow-moving assets, items which are subject to dynamic usage variations require much more current data. Timeliness, therefore, is a function of the potential dynamics of a particular product.

While it might be feasible to develop an inventory accounting system that could give virtual real time status on the number of golf courses in a small town, it would be an extreme waste of resources. In this example, the number of courses is small and the quantity virtually fixed. The answer would almost always come back as "no change," or at best, a change of "one." Therefore, the degree of timeliness must be a subjective judgement made by the user of the data.

D. ACCURACY

The accuracy of any accounting system must be a function of several variables. Ease of accounting is one variable that usually comes to mind.

Banks can be expected to maintain a close accounting of assets because the item they are dealing with has an obvious common denominator.

Another important variable to be considered is the basic need for accuracy. Industry has led the way in working with approximate quantities. For example, it is common practice to estimate the number of low-cost items in a container rather than perform an absolute count. Often an item manager will be able to make perfectly rational decisions based on approximate inventory quantities.

In some cases, the value of the item will play an important role in determining the needed accuracy. While an absolute count of the pocket calculators owned by the Navy may be ridiculous, the exact number of PHOENIX missiles would be a different matter.

Often there are items that are given special inventory accounting attention because of their criticality. One-hundred-thousand-dollar missiles have been held up from production delivery for the want of a sixty-cent capacitor. When shortages such as this occur, the critical components are often given special accounting attention, at least until the shortage is overcome. Although the item is cheap and would normally not warrant an accurate accounting, a count is sometimes essential. Each capacitor located by the contractor can mean a one-hundred-thousand-dollar sale.

E. COST EFFECTIVENESS

While all of the previously mentioned attributes are important, the element of cost weaves its way through each. For any inventory accounting system to be worthwhile, it must be worth its implementation and operational costs. It would be unreasonable to expect to spend more to track an inventory than to purchase it. The question then is "how much should be spent to track an inventory?" The answer must be viewed as a trade-off analysis.

The trade-off evolves from the need for additional or excess inventories which are necessitated by having limited knowledge of the exact inventory size. For instance, if an inventory of one thousand items is needed, but the accuracy of the physical count may vary as much as ten percent, an overbuy of ten percent may be necessary. Thus, procurement costs are ten percent above the minimum requirement.

One should look very carefully at the need for timeliness, accessibility, and accuracy and compare the costs involved in gaining these attributes with the costs of compensating the inventory size. As an extreme example, one would not expect to spend much money to maintain a close track on items worth, in total, less than one thousand dollars. Certainly it would be foolish to spend a thousand dollars. But, in a more practical sense, one might be expected to spend several hundred thousand dollars to maintain a close surveillance of an inventory of items valued at several billion dollars.

F. CONFIDENCE

The concept of confidence should connote a degree of reliability of the system. While the system may be 100 percent accurate, one must be confident that is the case. If that confidence is not held, an accurate inventory quantity is meaningless to the manager. Conversely, if the manager's confidence is misplaced and the inventory system is truely unreliable, he may end up counting on assets that are nonexistent. Either situation is unacceptable. Therefore, it can be said that the usuable inventory accountability system must be reliably accurate.

G. RECONCILLIATION

An inventory accounting system, as with any other accounting system, may, at times, be in error. In recognition that a recorded count can vary

from the actual physical count, some form of reconcilliation is essential. Even if there are no errors, there are occasions when accounts need to be verified. No better way exists to verify an account than to actually count the quantity of items in stock. Perpetual inventory systems, while still needing a periodic physical count, have a unique advantage over purely periodic inventory systems. The advantage is that the count does not necessarily have to be made simultaniously. (Moonitz, Strehling, 1952, p. 251). In reconcilling a perpetual inventory, the concern is with variances in physical versus recorded quantities at various locations. While the counts need not be made in a "stop-action" mode, if time lapses exist between the counts, intermediate transactions must be taken into account. An optimized system would be one that has a built in error-correcting feature. At least a system must be mechanized so that when a physical discrepency is discovered, it is immediately corrected.

H. INPUT CONFIRMATION

The term confirmation, as used in this thesis, is often referred to as feedback. Persons providing inputs to a system need an acknowledgement that their input has been received correctly and understood. The confirmation can be as simple as immediate restatement by the receiver of the input, or can be in the form of a final output report. The function of confirmation should be prompt, simple and dependable.

IV. THE U. S. NAVY AMMUNITION MANAGEMENT SYSTEM

The Navy Ammunition Management System is called CAIMS (Conventional Ammunition Integrated Management System). The intent of CAIMS is to establish a single point of reference within the Navy for information relative to the worldwide status of Navy expendable, non-nuclear ordnance. Included are requirements, assets, production, expenditures, costs, and technical inventory management data regardless of inventory management or ownership responsibilities. (OPNAVINST 8000.13, 1971). CAIMS was designed to eliminate multiple reporting systems, provide CNO (Chief of Naval Operations) one real time computerized data base to make operational decisions and to reduce the reporting burden on the Fleet.

A. CAIMS NETWORK

The CAIMS Network is shown in Figure 1. CAIMS is programmed on a UNIVAC 494 digital computer located at SPCC (Ships Parts Control Center), Mechanicsburg, Pennsylvania.

B. INPUTS

Basically, CAIMS can receive inputs from anyone of 10 primary stock points (Naval Ammunition Depots and Naval Weapon Stations), 25 secondary stock points (Naval Air Stations, Naval Ordnance Stations and Marine Corps Air Stations), 26 Minor CONUS (Continental United States) activities holding ammunition primarily for internal consumption or testing, and approximately 500 Fleet and overseas activities.

The 10 primary stock points report to SPCC by TIR/SLIT (Transaction Item Report/Serial Lot Item Tracking) via AUTODIN (Automatic Digital Network), in accordance with MILSTRIP/MILSTRAP (Military Standard Reporting

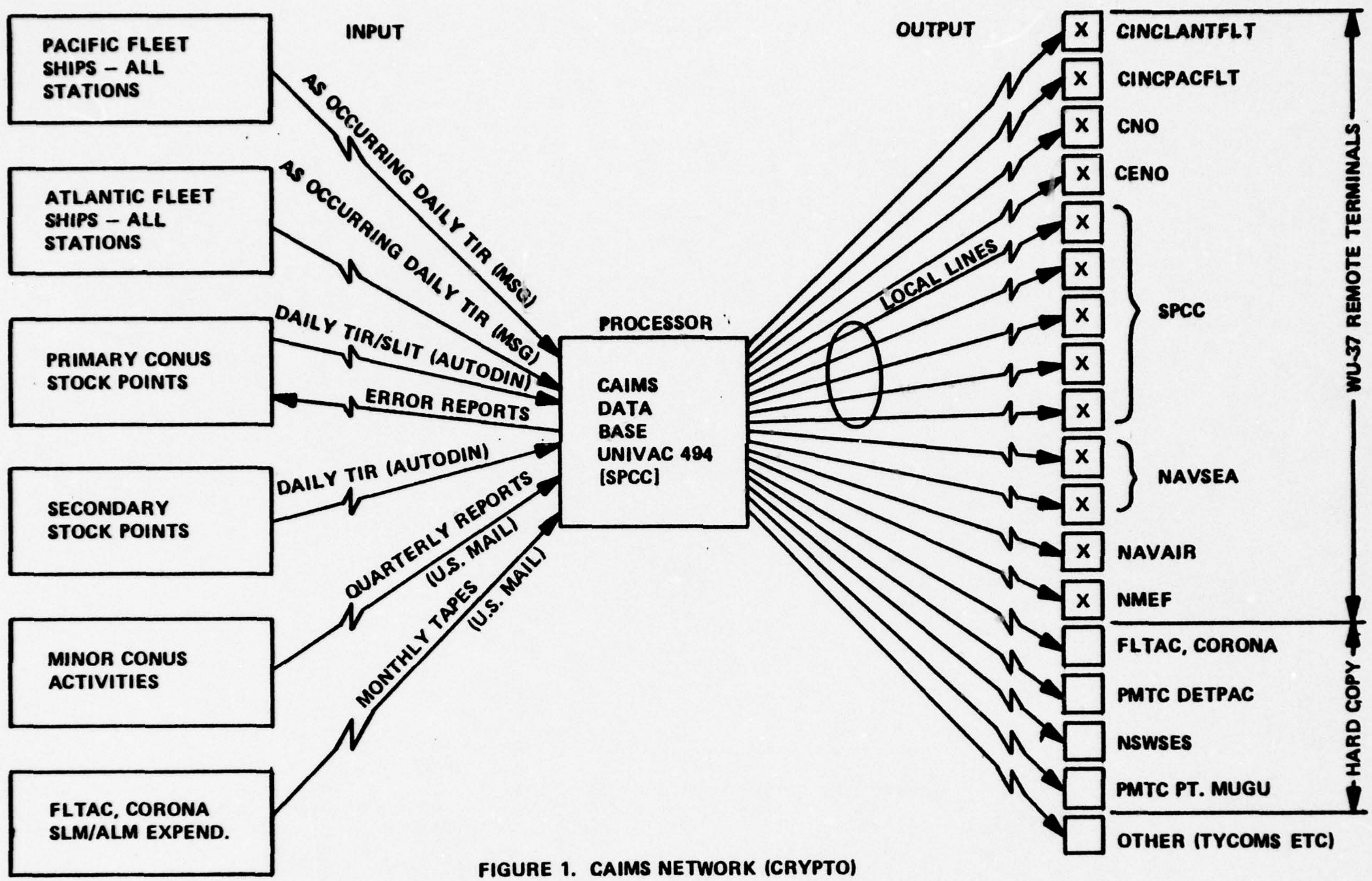

FIGURE 1. CAIMS NETWORK (CRYPTO)

and Accounting Procedures/Military Standard Requisitioning and Issue Procedures) on a daily basis. The 25 secondary stock points report to SPCC by TIR only, again by AUTODIN, also on a daily basis, and again in accordance with MILSTRIP/MILSTRAP procedures. The minor CONUS activities report a summary position of their assets or expenditures on a quarterly basis by U. S. Mail. All Fleet ships and overseas bases report to SPCC by message TIR on an as-occuring basis, i.e., any receipt, issue, adjustment, expenditure or reclassification is reported on the day it occurs. If no action occurs, there is no negative report. (SPCCINST, P--8010.12B, 1975).

C. OUTPUTS

CAIMS data is output to many different users by different means and in different forms. CINCLANTFLT/CINCPACFLT (Commander-in-Chief Atlantic Fleet/Commander-in-Chief Pacific Fleet), CNO, CENO (Central NOMIS Office), and Inventory Managers at SPCC, NAVAIRSYSCOM (Naval Air Systems Command), NAVSEASYSCOM (Naval Sea Systems Command), and NMEF (Naval Mine Engineering Facility) all receive on-line, real time output via the WU37 remote covered (crypto) terminal. Currently, there are 13 WU37 terminals in existence (none located at weapon stations).

Other activities obtain CAIMS data by mail in the form of SISRs (Selected Item Status Report) and/or Asset and Experience Data and also by mailed magnetic tape. TYCOMs (Type Commander) must rely on the mail system, and ships must rely on the TYCOMs for feedback.

D. ALM FUNCTIONAL FLOW (GENERAL)

ALMs (Air Launched Missile) are acquired as sections from vendors under contract to NAVAIR. An AUR (All-Up Round) is assembled from four to five different major sections. Sections are procured from both commercial and

military manufacturing activities, and are positioned by the acquisition manager at NAVAIR at a WPNSTA (Weapons Station) or a commercial contractor for assembly. (SAI, 1975, pp. 1-2 to 1-5). Upon receipt by a WPNSTA, the quantity and NSN (National Stock Number) of the sections are introduced into Navy Inventory by electronic TIR to the CAIMS data base at SPCC. Each serialized section is also introduced separately into CAIMS by a supplementary SLIT report keyed to the TIR quantity report by the TIR document number.

Upon assembly of sections to an AUR, an NSN is assigned to reflect an AUR and the individual sections are expended from inventory by TIR/SLIT reports. TIR reporting continues through the life span of the AUR occuring upon issue, receipt and change of condition, e.g., serviceable (A)/unserviceable (F), etc. SLIT reporting includes all the above actions, but is limited to WPNSTA reporting only. There is no serialized reporting when the AUR/ALM component is in transit, in the custody of the Fleet, INAS (Industrialized Naval Air Stations), or NAVAIREWORKFACS (Naval Air Rework Facilities).

Following malfunction or failure of prescribed tests, AURs and ALM sections are normally retrograded to the nearest IMA (Intermediate level Maintenance Activity) which is either MMMU-1 (Mobile Missile Maintenance Unit-1), Subic Bay, Philippine Islands, or one of the three continental WPNSTAs.

The IMA tests and disassembles the AUR and performs intermediate level maintenance on the individual sections. Should repair of a section be beyond IMA capability, the section is shipped to a depot level maintenance activity. The exceptions to the above are noted below:

(1) An unserviceable section transferred from MMMU-1 is usually reassembled into an AUR for ease of handling and economy of containerization.

The AUR is shipped to one of the WPNSTAs in CONUS where it is disassembled, inspected and retested, if necessary, before a final decision is made to ship it to a depot.

(2) Some operational NASs (Naval Air Station) and MCASs (Marine Corps Air Station) within CONUS perform the IMA function relative to disassembly and remating and request disposition instructions from NAVAIR on disposition of the defective units. Periodically, NAVAIR issues instructions to ship the defective units directly to an INAS for NAVAIREWORKFAC rework. During the retrograde process, TIR reporting is continued. Upon receipt of an AUR or component section, the WPNSTA begins SLIT reporting again. When an AUR is disassembled, the AUR is deleted from the inventory and each component is reported into CAIMS as an added inventory asset by serial number. TIR and SLIT issue reports are made anytime a GCG (Guidance and Control Group) is transferred to a depot. When the INAS receives the GCG, only a TIR report is made to CAIMS, i.e., NSN quantity only, no serial numbers. Next, another TIR is made to change the condition code of the unit when the unit is inducted into the NAVAIREWORKFAC.

When a GCG has been reworked and tested satisfactorily by the NAVAIREWORKFAC, another TIR is made by the INAS to report the unit in serviceable (A) condition, and the unit is held in storage until the INAS receives issue directions from NAVAIR. It is important to note that no inventory reporting is made by the NARF when the unit is under repair. Any section, however, that has been determined by the NARF to be beyond economical repair is surveyed from Navy assets and reported as expenditures by INAS. This removes the quantities from CAIMS only by NSN.

The inventory manager directs the INAS to issue serviceable GCGs normally to WPNSTAs where they are once again assembled into AURs. Upon shipment to the WPNSTA, a TIR is made to CAIMS and receipt by the WPNSTA

is both TIR and SLIT reported. Upon AUR assembly, the individual sections are expended from the inventory to the AUR, and the AUR is reported as new inventory, thus beginning the cycle again.

A Functional Flow diagram is shown in Appendix B.

E. DOCUMENTATION

There are three general catagories of documentation associated with the movement of AURs and component sections. They are "transfer and receipt" forms, "production and maintenance" forms and automated system output documents.

Transfer and Receipt--DD Form 1348-1, "Department of Defense (DoD) Single Line Item Release/Receipt Document" (NAVSUP 437) is used for movement between DoD activities as the base accountability document. The DD Form 1348-1 is also used for ALM hardware movement within the WPNSTA. In addition to the DD 1348-1, 12ND NWSC 8015/16, "Receipt/Expenditure Transfer--Miscellaneous Ammunition (Work Sheet)," and, in some cases, Form 1149 are also used. For movement from a commercial contractor to a DoD activity, a DD Form 250 serves the same purpose.

A general receipt card (Alameda), or a component induction card (Norfolk) which are both machine generated by the UADPS/SP (Uniform Automated Data Processing System for Stock Points), are used within the INAS/NARF to move ALM hardware from the INAS Supply Department storage to the NARF depot level maintenance shop. The completed section is transferred from the NARF to INAS Supply Storage on a general return card (Alameda) or a component receipt card (Norfolk). Accountability is maintained through shop order cards while the unit is under repair in the NARF. These cards are generated by the NARF workload control system.

Production and Maintenance Documents--The BOM (Bill of Materials) specifies work to be performed and estimated material requirements, and

is prepared by the PP&C of the WPNSTA. NAVORD Forms 4790/5(7A) "Shore Activity Maintenance Data Collection System" (MDCS) are used to collect maintenance data and NAVORD Forms 4790/5(7B) are used to collect configuration data. Both the BOM and MDCS documents, in addition to either the DD 1348-1 or the DD 250, are used as source data for the daily update of the NOMIS (Naval Ordnance Management Information System) by the AD&C (Ammunition Distribution and Control Division) at the WPNSTA. Indirection cards, stow cards, and transfer and receipt documents serve the same purpose for the UADPS/SP at the INAS.

Automated Systems Output--Transaction cards for AUTODIN transmission to SPCC are generated by both the NOMIS and the UADPS/SP at the WPNSTA and INAS, respectively for the daily update of CAIMS. Although both systems provide TIR cards, only NOMIS has provisions for serial number control and the capability of providing SLIT cards. Hard copy printouts are generated on a periodic basis from the CAIMS data base. This information is available to the IM via WU37 remote terminal.

V. THE U. S. AIR FORCE AMMUNITION MANAGEMENT SYSTEM

A. SYSTEM MAKEUP

The USAF Ammunition Management System provides strategic data for the control and management of reportable (selected) ammunition items, air interceptor missiles and air-to-ground missiles (AIM and AGM). The computerized system referred to as the DO-23 is comprised of four subsystems: (1) the Ammunition Asset Reporting System (DO-23A), (2) the Ammunition Requirements Computation System (DO-23B), (3) the Ammunition Lot Number Reporting System (DO-23C) and (4) the Ammunition Transportation Reporting System (DO23E). This thesis will focus on the function of the DO-23A system only.

B. FUNCTIONS OF THE DO-23A

The DO-23A, located at Hill Air Force Base, Utah, provides the computerized heart of the Air Force's ammunition accounting system. Ogden Air Logistics Center acts as the office of primary responsibility for the AFLC (Air Force Logistics Command). Input data from throughout the world are processed by the DO-23A's IBM 7080 computer. Input data reports from more than 250 locations throughout the world are compiled to provide periodic status of the distribution and condition of selected ammunition items. There are 41 total products which include reports, control files and error lists. There are eleven routine reports published by the Ogden Air Logistics Center at Hill AFB. These reports are:

Monthly Consumption List
Reportable Item Master File by DODIC
Reportable Item Master File by NSN
Missile Asset Listing
Warner Robins ALC Missile Consumption

Transaction Summary List
USAF Ammunition Summary Report
USAF World Wide Ammunition Asset Report
Reportable Item Master File by Manager Designator
Master Location File by SRAN
Master Location File by Base Name

In light of the intentions of this thesis, only the World Wide Asset Report will be of concern. This report contains the basic detail from which the item manager can determine actions required for tactical redistribution. The listing indicates quantities, condition (serviceable/unserviceable) and location of all reportable items. In addition, the items reported in transit by a reporting activity appear as "due-in" items for the activity which is to receive them.

C. REPORTABLE ITEMS

Only certain items need be reported to the DO-23A system. These items are on an output listing (card outputs) of the Headquarters ALC (Air Logistics Command) DO-71 System. The card outputs provide the basis for establishing base and command reportable item files. Item managers from either Ogden or Warner Robins AFLC must have previously registered the item with the DO-71 system for it to appear on the Headquarters AFLC SNUD (Stock Number User Directory). The system also identifies all item types stored in remote accounts. Each month a revised SNUD is published to potential reporting activities. Major commands are required to "achieve and maintain an Air Force acceptable reporting error rate of less than one percent." (AFM 67-1, 1975, p. 20-12).

D. REPORTING

Status reports on all reportable items are required to update the DO-23A system as changes occur.

1. Purpose of Reports

The reports provide the basic data which, when processed by the DO-23A system, allow the inventory managers to:

a. Provide a data base to prepare higher level directed reports.

b. Provide inventory and transaction visibility to the IM for redistribution actions, requirements computations, and determination of readiness posture for actual or planned operations. (Four major commands use their DO-78 systems for comparable management purposes).

c. Expedite distribution/redistribution or replacement of stocks when required due to suspension action.

d. Program surveillance testing to provide reliability data.

e. Predict the effect of anticipated losses through aging.

f. Determine and affect replacement and disposal programs.

g. Rotate stocks of items of limited service/shelf life to obtain maximum use.

h. Notify activities concerned of any suspect or dangerous lots. (AFM 67-1, 1975, p. 20-65).

2. Who Reports

All activities in possession of reportable assets are required to provide input data for the DO-23A system. The reporting procedures vary, however, for different commands. Data from a satellite base will be transmitted to a host base, compiled with other host and satellite data and then transmitted to the DO-23A system in Ogden. Some major commands choose to collect data from subordinate bases on the DO-78 and retransmit to Ogden. A base may be a host or a satellite, and may be in a DO-78 or non-DO-78 command. In the event more than one command occupies the same base, generally the host command will be the responsible reporting agency.

One additional reporting activity is the Warner Robins Air Logistics Center. Warner Robins provides inputs relative to the transactions of

assets that are removed from or being added to the normal reporting stream, i.e., missiles and components shipped to and from the Navy's rework facility or newly procured items.

3. Report Periodicity

Bases or reporting activities prepare reports each time a transaction occurs that changes either the serviceable or unserviceable balance or the peace-time operating level of a reportable item. Bases equipped with Univac 1050 II computers schedule their systems to process reports daily. Noncomputerized bases submit reports as directed by their major commands. Major commands and bases reporting direct to Ogden ALC process reports weekly. End-of-the-month reports are also required. These reports indicate the report number of the last report previously submitted. A sequence number is assigned to highlight missing reports and allow verification or corrective action.

4. How Reports are Submitted

If DCS AUTODIN facilities are available, both bases and major commands use them. Precedence for all electrical transmissions are not lower than "priority." Input data are automatically translated to the AUTODIN format using either a 1050 II base system or DO-78 major command system. Satellite and remote independent bases without computer access keypunch their data, for ease of input, into the automated systems. If DCS AUTODIN facilities are not available, base level activities report by telephone, message, or, at the option of their major command, by mail if the total mailing time does not exceed three days. Regardless of the reporting method, reporting units maintain copies of all transaction reports for a period of one year. These reports are saved for the purpose of affecting any reconcilliation that may be necessary. Appendix C is a flow

chart which portrays the information flow within the Air Force Ammunition Management system, and displays the interrelationships for reporting between commands.

E. DO-23A PROCESSING OF INPUT DATA

Regardless of the source of input data, when the information is received at Ogden, it is in punched-card format. The input data is screened automatically by the DO-23A for obvious format errors. When input data from the field which has been preprocessed by the base or major command systems is in disagreement with what normal calculations the DO-23A performs, the input data are accepted as being correct. This process is referred to as "overlay" by the Ogden personnel. (Kopinsky, 1976). The assumption is made that the activity holding the assets has the most likely probability of being correct. Of course, when there are major discrepencies, the personnel at Ogden verify the input data through direct contact with the reporting base or command.

F. THE USE OF THE DATA

The World Wide Asset Report provides the item managers with a numerical picture of the quantities, location and condition of their system assets. With this purview, the item manager is able to determine the possible availability of assets for redistribution and compute requirements for buying for budgeting purposes and continued worldwide asset support. Since the report indicates the distribution of major subassemblies (in the case of missile assets), the item manager can, if necessary, match up the various subassembly combinations to maximize the total round utility. This mating and matching, however, is generally handled manually by the item manager.

G. RECONCILLIATION PROCEDURES

An annual reconcilliation of asset balances between Ogden ALC and those major commands maintaining and operating a DO-78 system, and between Ogden

ALC and those bases or activities reporting directly to Ogden ALC is required in November each year. Prior to conducting the base-to-command or base-to-Ogden ALC reconcilliation, a base physical inventory is required. The Air Force refers to this action as their annual "wall-to-wall" count. After the reconcilliation is completed, new report sequence numbers are used, beginning again with "one."

H. SUPPLEMENTAL SYSTEM

While the DO-23A system provides the "official" data relative to asset distribution, supplemental information is also needed on some systems. For instance, on the SPARROW and SIDEWINDER systems, when missile assets are sent for rework, they are held by a "non-reporting" agency, e.g., the U. S. Navy's rework facility. Since these assets tend to become "lost" from the system, the item managers maintain an unofficial manual log whereby they are able to piece together a reasonable total asset picture. (Upright, 1976).

I. SPECIAL FEATURES

A very important item that should not be overlooked in the Air Force inventory accounting process is the assignment of a MASO (Munition Accountable Supply Officer). This assignment at each base or command provides an accountable person for munition handling and reporting responsibilities.

It is the responsibility of the MASO to ascertain that all required reports are completed and to provide whatever training necessary to insure the proper input data are submitted at the proper time. Additionally, he is responsible to be certain that proper storage facilities and procedures are available for requisitioned assets. He also has the responsibility to check the base's assets against their authorized quantities, and to take the necessary action to rectify variances.

VI. AN INDUSTRIAL SYSTEM--MATSON NAVIGATION COMPANY

A. TYPE OF BUSINESS

The Matson Navigation Company, a subsidiary of Alexander and Baldwin, Incorporated, is engaged in the business of freight transportation primarily on ocean-going vessels. They are the exclusive transporters of merchandise between the mainland west coast ports (Oakland and Los Angeles) and the Hawaiian Islands.

B. BACKGROUND

In the late 1950s, Matson began converting to large merchandise container-vans to facilitate loading, handling and accounting functions. Today all of Matson's ships, except those still transporting bulk commodities such as sugar, have been converted to accommodate van-packaged loads. Each of these ships can accommodate approximately 1000 container-vans.

C. DEVELOPMENT OF CONTAINER EQUIPMENT CONTROL SYSTEM

In 1972, Matson installed CECS (Container Equipment Control System) for the purpose of making container yard operations more efficient. (Burkart, 1976). CECS was designed to provide CURRENT information quickly on containers and container equipment for the port regions of Oakland and Los Angeles. Some benefits that have been realized by CECS are: (Matson CECS Manual, 1972).

--Better customer service through:
  a. Advance knowledge of equipment availability.
  b. Ability to trace container location easily.

--Better utilization of equipment to minimize capitalization.

--Avoidance of lost equipment through systematic reporting of equipment out of yard.

--Easily accessible information for special purposes such as inventory reporting.

D. FUNCTION OF CECS

Appendix D is a functional flow diagram of the Matson CECS. As can be seen in Appendix D, current information in the CECS is maintained through the use of direct access remote on-line stations located at strategic work areas throughout the container yards. The direct access stations are keyboard entry and video display stations and are "on-line" to a dedicated partition in a computer located at the Matson Navigation Company Corporate offices in San Francisco. The system is "on-line" approximately 20 hours each day through full duplex private lines.

All container movement in and out of the gates or on and off ships is recorded immediately using the remote terminals. Remote terminals are available at each gate, in the yard towers, and at the Matson Corporate offices in San Francisco. Receipt/release forms are printed remotely in the gate house under computer control. In addition, at the option of yard management, container movement within the yard or between the yard and ships is recorded either immediately or at periodic intervals. An extremely important feature of the CECS is that no entry is accepted by the computer unless it is consistent with previous entries or unless the operator makes a positive override of the computer edits.

Once an entry has been accepted by the computer, the information immediately supplants previously entered data. For example, Jones Trucking Company carrying container-van with serial number 12345 arrives at the gate in Los Angeles. The gate operator notes the serial number and enters it into the system. The system sends a rejection message back to the operator informing him that container-van 12345 is located at Smith Trucking Company in Oakland. If the gate operator verifies that he is correct, he can then

physically override the system and bypass the rejection message and enter container-van number 12345 in the system as being in Los Angeles. (This logically assumes, of course, that there are not two container-vans with serial number 12345). The container-van in Oakland whose number is unknown will be picked up by the inventory system as it passes an entry terminal either at Oakland or Los Angeles, thus balancing the system again.

Hard copy of the video displays is available at all times through a printer unit located near the remote terminals.

Although CECS controls all containers while in the yard, once a container goes aboard a ship, it exits from the CECS control, whereas containers leaving by truck are generally "on a string" which will continue to be held by the CECS. For example, a container put aboard a ship bound for Hawaii is logged out as heading west. When that container reaches Hawaii, it may be put aboard another ship headed for Guam, but the records in the computer show that the unit is in or on the way to Hawaii. Only when that same unit is put aboard a ship headed for the mainland are the records updated. Since Hawaii does not have remote entry terminals, the records are updated via message received at the home offices. When the unit is off-loaded at the Matson facilities at either Oakland or Los Angeles, the records are further updated.

The above does not hold true if the unit is mounted on a trailer. Once the unit leaves the yard by truck, for drayage purposes, Matson has track on it at all times through the drayman.

As can be seen in Appendix D, the container number (or serial number) is used to trace the unit. There are other ways, of course, e.g., by dray agent, but container number is primary.

E. CECS REPORTS

Output from the system is in the form of reports generated on-line by the computer both for display and hard copy. An example of the daily output reports are listed below:

1. Summary of containers by type
2. Detail of containers by type and status
3. Equipment out of yard
4. Equipment inventory
5. Daily activity summary

An example of the hard copy output is shown in Figure 2.

The system is on-line from 0700 each morning to 0300 the following morning seven days a week. Between 0300 and 0700 each morning, the system is updated to reorganize files, accept new tapes, accumulate history information and generate reports.

F. OUTSIDE APPLICATION

It is interesting to note that Matson not only tracks their own container-vans, but also fills, ships and tracks container-vans for other companies. All together, Matson tracks approximately 40,000 containers of various sizes (24 feet to 40 feet in length) and capacities which perform various functions (refrigerator containers, liquor tanks, fruit containers).

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TYPE	DESCRIPTION	TOTAL	EMPTY	E/B	W/B	OUT
ROF	LT LEASE RORO 40FBED	13	12			1
ROL	LT LEASE RORO 40LBOY	2	2			
100	MNC STNRD DRY CONTNR	995	593	38	62	302
190	MNC STD DRY CTN SIDE	2	2			
200	MATSON HI CUBE 40FT	76	43	4	9	20
250	MNC STD DRY CTN AERO	1	1			
300	MNC AUTORACKS INTERI	4	4			
310	MNC AUTORACKS WC-HAW	23	23			
340	AUTO FRAME VAN 40 FT	55	55			
401	MNC FLATRACKS - OLD	6	4		1	1
405	MNC FLATRACKS - NEW	41	31		1	9
410	FLATRACKS-FE CONV	17	16			1
420	MNC CARBN STEEL TANK	1		1		
427	5600 GAL TANK-24 FT	1				1
450	MNC BULK FEED CONTNR	36	35			1
455	MNC SHLITZ MALT BULK	2				2
470	MNC HALFFLATRACK40FT	6	2		1	3
480	MN HI CUBE FLAT RACK	64	47	3	6	8
500	MNC STD INS NON REEF	14	12		1	1
600	MNC STD DRY VENT CTN	39	35		1	3
610	MNC STNRD DRY CONTNR	126	104	4	2	16
670	MNC STD DRY OBNX CTN	1				1
800	MNC STD REEF-4 WALL	21	14	1		6
810	MNC STD REEF-2 WALL	72	38			34
840	MNC STD RFR W-DAMPER	38	13		4	21
850	MNC ME/RA REEF 4 WAL	16	16			
860	MNC ME/RA REEF 2 WAL	9	8			1
870	MNC STD REEFR-TECTRL	36	23		1	12
880	MNC ME/RA REEF-TECTL	2	2			
20F	MISC 20 FOOT DRY	20	5	2		13
701	SOCO JET FUEL ANTI-T	2	2			
702	GASPRO MODIFIED	2		1		1
703	CASTLE COOKE DUAL CO	1				1
740	SOCO SILCA GEL CATAL	5	4			1
745	SCHLITZ BREW CO TANK	19	16			3
751	GASPRO BULK RESIN	2				2
775	MN LEASE TANK EDIBLE	3	3			
791	JOHNSON LINE	3				3
210	ATSF RR STD DRY SIDE	3	2			1
26A	ATSF STD DRY SIDE	11	9			2
260	WP RR STRD DRY CNTNR	7	7			
261	DRG RR STRD DRY SIDE	11	11			
263	UP RR STNRD DRY SIDE	1	1			
718	CB&Q RR INSL NO-REEF	1	1			
760	AT&SF RR INSL N-REEF	9	8			1
CTU	40 FT ALUMN LEASE	2	1			1
TOF	TOF 40 FOOT	93	13	9	6	65
	TOTALS	1914	1218	63	95	538

FIGURE 2 - Typical Hard Copy Printout (Matson)

VII. SYSTEM ASSESSMENTS AND COMPARISONS

A. SYSTEM ASSESSMENTS

In Chapter III, the important qualities of an inventory accounting system were developed and discussed. In Chapters IV through VI, the inventory accounting systems used by the U. S. Navy, U. S. Air Force, and Matson Navigation Company respectively were described. In this Chapter, the three systems will be subjectively assessed by evaluating their performance characteristics relative to the attributes discussed in Chapter III. In order to provide a degree of quantification to the overall assessment, each system's performance relative to each attribute will be determined. The ranking will be on a scale from one to four as follows:

1. Poor
2. Fair
3. Good
4. Excellent

Appendix E elaborates on the rating system used.

1. Assessment of the Navy Ammunition Management System

a. Simplicity

From the viewpoint of putting data in the system and retrieving data from the system, the Navy system is relatively simple. Operators can prepare punched cards and/or magnetic tapes for input with relative ease. Outputs consisting of hard copy printout via remote terminal, magnetic tapes (for those needing data but having no remote terminal facilities), and periodic reports are reasonably available.

The Navy system provides answers to three of the basic questions, providing one has time to spend sorting through all the data spewed forth

by the system. The question it does not answer is exactly which assets (by serial number) are located where.

Based upon these assessments, the system is rated as fair.

b. Accessibility

The accessibility of the Navy system is poor. This stems from the fact that only SPCC can input information directly into the system. TIR/SLIT information is transmitted by a WPNSTA to SPCC by AUTODIN or U. S. Mail. Consequently, there is no method or way that a WPNSTA can directly access the system. This is not only true for WPNSTAs, but it is also true for any other activity, including NAVAIR.

CAIMS does generate some monthly output reports to the IMs, but usually they are based upon data at least six to eight weeks old. (Witter, March 24, 1976). In addition, all of these reports provide the same information only in different formats. (Leake, 1976). True, the IMs can obtain hard copy readouts from the WU37 remote terminals, but again, these readouts are based upon noncurrent information. Classification of the reports and readout (SECRET and CONFIDENTIAL) also limit the distribution accessibility.

c. Timeliness

The Navy system, relative to timeliness, is suspect. The asset picture can change daily, sometimes hourly. When inputs to a complex system, with respect to movement or expenditure of assets, encounter delays of several days before the changes are recorded, the system can hardly be thought of as timely. (SAI, 1975, pp. 2-6). As a matter of fact, there have been times when backlogs of TIR cards have been as large as 3,000. (DoD Audit Report, 1973, p. 26). These backlogs have led NAVAIR to resort to an informal system of reports, messages and telephone calls as a more current source of inventory data. (Sullivan, 1976). In rating the attribute of

timeliness of the Navy system, the authors feel that it can be rated no better than poor.

d. Accuracy

The Navy found that its inventory accounting system was too inaccurate for use in determining the total number of missiles possessed, and felt that the formal system was too far behing "real time" to give accurate information. (DoD Audit, 1973, p. 26). Although the CAIMS was designed to provide NAVAIR with accurate daily CONUS inventory by means of the WU37 terminal, the system experienced problems due to processing delays and rejection of TIR cards. (DoD Audit, 1973, p. 26). Because of these delays and rejections, the monthly inventory reports prepared by the IMs at NAVAIR consistently showed adjustments as well as substantial differences between official asset figures and data maintained by another source, i.e., the missile contractor. (DoD Audit, 1973, p.25). Recent discussions with NAVAIR program managers attest to the fact that the situation has shown little improvement. (Wells, Van Dyke, 1976).

Based upon the above, the authors can rate the accuracy of the Navy system no better than poor.

e. Confidence

The fact that the NAVAIR IMs chose to initiate an informal system consisting of telephone calls, messages and informal reports as a more current source of inventory data indicates a distinct lack of confidence in the formal system. The informal system became the basis for the Navy's inventory quantities. (DoD Audit, 1973, p. 27). Therefore, the confidence in the Navy system deserves a rating of poor.

f. Cost Effectiveness

This attribute, relative to the Navy system, has to be rated no better than poor, if for no other reason than the accuracy, confidence, accessibility and timeliness are poor.

When the inventory system cannot produce a count of items that can be believed, this then leads to overbuying of the asset, which in turn means that taxpayer dollars are being spent needlessly. The domino effect then takes over, i.e., more spare parts, containers, launchers, etc. have to be purchased, not to mention more people employed to repair and test the missile.

g. Reconcilliation

The Navy system can be rated no better than poor relative to reconcilliation features. The fact that large discrepencies continue to exist in the count justifies the above statement. (DoD Audit, 1973, p. 27).

The Navy has no provisions for conducting a "wall-to-wall" physical count of missile assets for the purposes of reconcilliation on a routine basis, i.e., either annually or semi-annually. In fact, the authors have personal knowledge of only one "wall-to-wall" inventory being conducted on one type of air-launched missile in the past four years. (Naval Missile Center Messages, 181956Z Jan 73, 242329Z Jan 73). Though the inventory count was taken worldwide, the records on this missile asset were never up-dated. Therefore, the information distributed to users was no better than before the count was taken. (Sullivan, 1976).

h. Input Confirmation

The Navy system provides no direct feedback on inputs. Feed-back occurs only by exception, and then it is less than timely, as it usually is fed back in the form of an error card via the U. S. Mail. (Ferrell, 1976). As a consequence, the activity making an input never

really knows whether or not its input data ever got into the system in a correct and timely manner. (Meehan, 1976). Except for very obvious errors in quantities, errors normally will enter the system undetected.

The system, therefore, deserves a rating of not better than poor relative to confirmation of input data.

2. Assessment of the Air Force Ammunition Management System

a. Simplicity

The Air Force Ammunition Asset Reporting Systems, while part of a more complete inventory management system, has been made simple in that it functions to provide the manager with an overview of his total asset picture. While the asset reporting system is required to provide inputs or work in conjunction with the ammunition requirements system, the ammunition lot reporting system and the ammunition transportation reporting system, it still provides the independent status for which it is needed. The system also provides answers to three of the four basic questions. It provides information related to quantity, location, and condition. It does not, nor was it intended to, provide serialized tracking of assets.

Because the system inputs are basicaly simple, they should not confuse the person preparing them. Examples of some of the input forms the Air Force uses are shown in Appendix F. The output reports are in a format that lend themselves well to manager use. Copies or examples are not included because of their classification. With respect to simplicity, the Air Force system is rated as good.

b. Accessibility

Inputs to the Air Force system are reasonably straight forward. There is adequate documentation to indicate what is needed to provide inputs and what format the inputs should follow. In addition, there appears to be adequate pressure to cause the necessary response.

The main problem appears to stem from the diverse location of the accessing activities and the variations in the methods of input. With some satellite bases reporting directly to the DO-23A and other via major commands (and via the command's computer), the sense of communicating with the DO-23A must at times appear to be nebulous. As the system is designed, there is a feeling of "feeding a system," but there is also a sense of doubt about what the system has done with the input. The accessibility of the output is severely limited by the fact that reports to the users have a periodicity of one month. The classification of the basic output report (SECRET) also acts as a roadblock to accessing the computed information. With respect to accessibility, the system can be rated no better than fair.

c. Timeliness

The DO-23A monthly output means that, at best, the system (from the field user's standpoint) is current on the day the data are processed, printed and delivered. Information needed during the interim period is only available at the computer center when, and if, a special run can be made. Inputs from the field come in by various media (including the U. S. Mail) and at different rates. Input data which are either garbled in the transmission or which contain obvious format errors detected by the DO-23A edit system must be clarified and verified by a special communication between Ogden and the activity putting in the data. All such verification activity creates delays in accurate data processing.

An additional area where the Air Force's system lacked timeliness was that it took months to register a new item in the system. During the interim, the item went unreported.

Based on the above assessment, the timeliness of the Air Force system should receive a poor rating. However, since the monthly report

interval was considered satisfactory by the primary data users, the authors rate it instead as fair.

d. Accuracy

Relative to accuracy, the Air Force system should be rated as poor. While the data tends to be input properly by field units with a required one percent accuracy, there are areas in the logistics flow that are not covered by reporting agencies. For example, missile guidance assemblies diverted to the Navy's rework activities for repair are dropped from the system and go unreported until the item manager at Warner Robins signals that the units are repaired and are reissued. (Upright, 1976). Additionally, units reported in transit tend not to be removed from that status, especially when sent to rework, and, thus, often are counted twice. (DoD Audit Report, 1973, p. 27).

One other difficulty arises with reported items that are not registered properly with the system. These items are not accepted by the DO-23A and, thus, disappear from the inventory. An example is the SPARROW AIM-7E-3 missile. Because the AIM-7E-3, which is converted from the AIM-7E-2, is not registered properly at this time, the system has thus far rejected the inputs for several thousand assets. These items seem to "disappear" from the inventory. Approximately one year ago, the visibility on $12,000,000 worth of assets was lost due to an accounting quirk. (Walker, July 13, 1976). Had the discrepency not been subsequently discovered, replenishment to an overstocked status would have resulted.

e. Confidence

With respect to confidence, the Air Force system should be rated as poor. This statement refers to the purely mechanized system. If one considers the "total" system, which includes the informal inputs provided

by some item managers, i.e., private logs, independent listings, and personal observations, the reliability then begins to improve, but it is still far from optimum. (DoD Audit Report, 1973, p. 26). The air-launched missile managers tend to use the DO-23A listings to verify what they already know. For example, the managers often take the numbers given by the DO-23A printout as accurate as long as those numbers agree approximately with their estimates. If there are obvious disagreements, the values which they "know" to be correct are used. (Waller, 1976).

f. Cost Effectiveness

For a system to be considered cost effective, it must yield information at less cost than the value the users derive from the information. The Air Force system's performance, relative to accuracy, confidence, timeliness, and accessibility have a direct bearing on its cost-effectiveness rating. Without easy and timely access to quantitative data, and the confidence that the data are correct, a manager has but one alternative; approximation. Using approximate data, the manager cannot buy the exact quantity necessary, but must in reality buy a percentage above that amount that is roughly equivalent to the inaccuracy that he perceives in the inventory system. Therefore, the cost-effectiveness rating of the Air Force system should range somewhere between fair and poor. These were the ratings given to accessibility, timeliness, accuracy and confidence, respectively. Since, in this paper, only integer ratings are being used, the Air Force system's cost-effectiveness rating is assessed at fair.

g. Input Confirmation

The Air Force system is assessed as poor relative to confirmation. The system provides virtually no direct confirmation on input reports. The direct feedback is provided only in the event of exceptions. If the

data submitted creates an edit error on the DO-23A system due to format or sequence number error, the activity entering the data can expect a direct query. If there are other than obvious errors in the quantities, they will go undetected. A simple confirming notice is not provided the activity making the input.

h. Reconcilliation

Relative to the attribute of reconcilliation, the Air Force system is assessed as fair. In the design of that accounting system, the need for an annual reconcilliation is well recognized and is a well-documented requirement. Based on the information provided by personal interview (Kopinsky, 1976), the annual November "wall-to-wall" count is often delayed and sometimes cancelled entirely. Thus, there are times when reconcilliation only occurs every two years. Additionally, the quality of the annual inventory could easily be suspect because it is routinely done by the same persons in the field that maintain the perpetual inventory logs. This violates a basic auditing precept that one cannot audit oneself. (Newman, 1958, p. 1).

3. <u>Assessment of the Matson Container Equipment Control System</u>

a. Simplicity

The Matson system is considered to be excellent relative to simplicity. The system has been designed to provide the outputs presently needed by management. The system is so mechanized as to allow growth if additional algolrythms or new output formats are later desired. Persons needing particular information from the system can access the system from any of Matson's terminals with only a minimal amount of training. Inputs to the system are equally simple.

Although the Matson CECS is designed to function as a tracking system for containers, it is compatible with a more complex system which

records and processes the invoices, bills, etc. for the contents of the containers. While these two distinctly different systems share parts of the same computer and some of the basic input information, each operates (from the output point of view) as if there were no common link.

b. Accessibility

The Matson inventory tracking system rates an excellent accessibility grade. Inputs can be made from any of many terminals. Outputs are available in virtual real time. Corrections can be made as errors are discovered using any of the terminals. Management data can be called out in formats that meet virtually any need.

c. Timeliness

If the timeliness of the Matson container tracking system were evaluated only on the containers held in the west coast yards, the system would clearly be rated as excellent. However, if the containers that are in place in Hawaii are considered, the system should then rate somewhat lower. There is an accepted time lag on input data for containers in place in the islands. Therefore, with respect to timeliness, the Matson system actually should be rated as good.

d. Accuracy

Based on the authors' perception of how the system is mechanized, the accuracy of the Matson system is <u>at least</u> good. This perception was reinforced when in an interview, the Matson representative stated that their errors are less than a fraction of a percent. (Burkart, 1976). The authors' concern is with the potential loss of containers that are shipped to the islands and then go unreported for long periods.

e. Confidence

From the aspect of confidence, the Matson CECS should be rated as excellent. Both upper management and lower working levels use the system

with a great deal of confidence. The ease in which data can be gathered, tested, verified, and corrected on the spot tends to enhance the reliability of the system. For example, when a system can be accessed via remote terminal and the results verified by an actual yard count, it does not take long to develop an appreciation for the system's reliability. (Dawdy, 1976).

f. Cost Effectiveness

When questioned about the costs of the Matson CECS, the following written response was received from Matson personnel:

> Line costs vary with the distance involved. Personnel costs may be offset by personnel savings realized when manual systems were dropped.* Computer costs are hard to measure because only one partition of the computer is being used, and the computer would be needed by Matson in any case. (Matson, 1976).

While the previous statement does not provide a proof of the system's cost effectiveness, it can be demonstrated in another way. Matson developed the CECS to provide ease of tracking for their own containers numbering about 15,000. Foreign shipping firms have contracted with Matson to provide a similar service on their containers rather than do it themselves. Their willingness to pay the basic cost plus Matson's profit for this service is considered by the authors as an adequate proof of the system's cost effectiveness. Therefore, with respect to cost effectiveness, the Matson CECS is rated as excellent.

g. Input Confirmation

Matson's CECS lends itself to rapid confirmation of input data. Feedback is essentially immediate and verifies that the intended information was received correctly. For example, when the gatekeeper in Oakland records the receipt of container serial number 12345 but makes an error and inputs 13245 (unless both serial numbers were previously entered into the system as being in the Oakland area), an input error will be displayed. In response

*Underlining included by the authors.

to the error signal, the gatekeeper must verify that he has indeed input the proper serial number of the container at the gate. If he has, he simply "overrides" the system. If not, he corrects his error. What happens when the two containers are located such that the computer would not respond with an error signal will be discussed under reconcilliation. Because the response is so fast and so clear to those entering data or questioning the system, the system should be rated as excellent relative to confirmation.

h. Reconcilliation

Matson's CECS deserves an excellent rating with respect to reconcilliation. As discussed in the previous section on confirmation, the act of correcting errors as they are detected is but one aspect of reconcilliation. The need for frequent reconcilliation has been well recognized and accommodated by Matson. In addition to the annual inventory for tax-reporting purposes, Matson performs a less detailed inventory for each yard on a quarterly basis. A daily inventory and reconcilliation of items received in or moved about the yard on any given day is also performed. Thus, in the example discussed under confirmation, the error made upon receipt, but not immediately caught by the gatekeeper, would be detected and corrected in the daily verification of items received and stored in the yard.

B. COMPARISONS

As is shown in Figure 3, the Matson CECS clearly rates superior to the Air Force and Navy systems in all attributes. In fact, the Matson CECS most nearly approaches what might be termed an optimum inventory accounting system. The Matson system thoroughly answers the questions of quantity, location, condition, and identity of its inventory components. In the authors' opinion, the only weakness in the Matson system would be the

ATTRIBUTE	RATING *		
	NAVY	AIR FORCE	MATSON
SIMPLICITY	2	3	4
ACCESSIBILITY	1	2	4
TIMELINESS	1	2	3
ACCURACY	1	1	3
CONFIDENCE	1	1	4
COST EFFECTIVENESS	1	2	4
INPUT CONFIRMATION	1	1	4
RECONCILIATION	1	2	4

FIGURE 2. SYSTEM ASSESSMENT SUMMARY

* 1 = POOR
2 = FAIR
3 = GOOD
4 = EXCELLENT

temporary loss of track of containers offloaded in the Hawaiian Islands. However, the Matson representatives indicated that even that facet was being considered for remedial action by the plan to install direct access terminals in the island yards and offices. (Burkart, 1976).

The Air Force Ammunition Management System, while not rated as high as that of Matson, had only three attributes that were rated as poor. These three (accuracy, confidence and input confirmation) are related in the following way.

When feedback (input confirmation) is slow or nonexistent, the accuracy of the system will surely suffer because input errors will go undetected. At the same time, there is no way to establish any degree of confidence in a known inaccurate system. However, it is understood that the Air Force is now in the process of reassessing the present system and intends to implement some major corrective changes. (Walker, March 17, 1976).

The following changes are presently being contemplated to improve the Air Force Ammunition Management System:

--Increase base/depot maintenance asset visibility on items (1) due in for overhaul, (2) condemned, (3) due in for maintenance, (4) due out of maintenance, and (5) in "floating stock."

--Record ownership account codes.

--Perform monthly reconcilliation of assets by base (internally computed).

--Improve analysis of war reserve material, etc. to include actual levels on hand versus authorized quantities.

--Record and monitor inter/intra area asset transfers.

--Record and monitor inter/intra area asset receipts.

--Perform asset inventory adjustments.

--Calculate total recorded assets by command

--Calculate total recorded assets by area.

While the Air Force system may not be as optimum as that of Matson, it must be remembered that it encompasses a much larger geographical area and involves a larger component mix than does the Matson system. The authors feel that the Air Force system needs particular emphasis placed on the track of high-cost items.

As can be seen rather dramatically in Figure 3, the Navy system rates below the Air Force system and far below the Matson system. Except for the aspect of simplicity, the system is considered unsatisfactory in all its attribute ratings. Because of the quality of the data and the lack of confidence that can be placed in that data, the manager's control of his program is weakened considerably. The manager is placed in an awkward position. If he accepts the quantities shown as accurate while they are low, he will underbuy and fall short of meeting Fleet requirements. If, on the other hand, the true count is really higher than indicated, the manager will overbuy and tie up funds unnecessarily in excess assets. If the manager recognizes the inaccuracy possibility, he is placed in the position of having to guess what to do and generally will recommend overbuying to assure that the Fleet requirements are met. Thus, excess funds will normally be tied up in inventory.

None of these options are considered reasonable in light of the cost per unit of many of the assets being procured and supplied.

VIII. DISCUSSION AND RECOMMENDATIONS

Based on the analysis of the Navy, Air Force, and Matson inventory accounting systems and their assessment relative to the eight attributes, it is obvious that the Matson system is superior to both military systems. While it is recognized that the military systems must serve a more broad asset distribution scenario, this is not considered to be the primary reason for the disparity in the system.

It is felt that the Matson system is superior to the Navy and Air Force systems for three primary reasons--(1) direct access terminals, (2) inventory accounting which is independent of other systems, and (3) serialized tracking.

A. DIRECT ACCESS TERMINALS

Direct access terminals provides the Matson system many advantages over the more manual systems used by the Navy and Air Force. First, persons entering data into the system have the advantage of immediate feedback. Input errors are easily detected and corrected with the direct access equipment. As an action occurs, it is almost immediately reflected in the system. Management can gain an extremely accurate picture of their inventory status in virtual real time. Because of the strategic placement of the direct access terminals, no critical action is taken on a Matson container without the action being recorded in the system. Because of the extensive care taken by Matson to place these terminals in strategic locations, their use has become second nature to the operating and management personnel. No other supplementary systems have been considered necessary.

B. INDEPENDENCE OF ACCOUNTING SYSTEM

The Matson CECS is designed to perform a valuable inventory tracking function. Although it is compatible with other systems used by Matson, e.g., invoice and billing systems, it is still independent. Matson personnel have been careful not to lose sight of the intended purpose of the system. It has been designed around the needs of the user. Output reports are concise and answer the questions asked. While the system may share inputs with, and provide inputs to, the other systems, it does not rely on other systems for its performance. Modification to the software for the other systems has no effect on the CECS.

C. SERIALIZED TRACKING

Serialized tracking of the Matson CECS provides tremendous visibility relative to where particular containers are located. It also provides a means of reference when one particular container needs to be found.

Besides these obvious advantages, there are some less obvious advantages which may in the long run be even more important. Serialized tracking provides a means of performing a much simpler audit of assets. It provides a means by which input errors can be easily detected and corrected. It provides a virtually automatic means of error reconcilliation, which in turn improves the system accuracy and results in increased confidence in the system's output data. Tracking by serial number can also provide other by-product data such as: (1) identification of containers needing repair, (2) identification of containers by consignee and loaded weight, and (3) identification of special cargo.

While the preceeding statements may provide adequate reasons for Matson's serialized tracking of containers, one might ask how this can be extended to apply to assets controlled by the Navy and Air Force.

Before answering this question, it is suggested that the aspect of the items' monetary value first be considered. Because of the quantity handled and the per-unit cost of these items, it is obvious that there is no need to determine which 30 caliber bullet or which MK82 bomb is being held, shipped, fired or dropped. For this reason, it would be far from cost effective, and probably meaningless, to track items of these types by serial number.

It is submitted then that items which have a high-dollar value and/or require routine maintenance should be tracked by serial number. This would apply to such items as missiles, launchers, aircraft guns, racks and high-value specialized ground-support equipment. For purposes of simplicity, examples will be expressed in terms of missile assets, but the same comments would hold true for any of the serialized components mentioned.

Probably the most important reason for recording by serial number, from an accounting viewpoint, is the self-correcting feature which was discussed in the assessment of the Matson CECS. When a serial-numbered unit is discovered in a location where it is not expected, the system feeds back a rejection message. If, after recheck, the input data are determined to be correct, the override action is taken and the system error is corrected. Thus, at least with respect to that particular item, the stored data are corrected. This type of action can only occur if on-line input terminals are positioned at strategic locations. In the case of Navy assets, the locations would include weapon stations, depots, and other intermediate shipping or handling points as necessary.

Serialized tracking provides an excellent means for maintaining a simple audit trail and deletes the need for extensive back tracking in order to reconcile accounts. This idea agrees with an accounting approach which states:

> When errors have been made during a series of years, and when the books are to be corrected at the close of the series, it is usually better to correct such errors as exist at that time, and to ignore errors which have been automatically corrected by counterbalancing errors. (Finney, 1949, p. 129).

Another important consideration is that in knowing the exact location of particular serial-numbered units, a manager has the capability of easily calling back, providing field repair and restricting from use units which are known or suspected to be defective. For example, if a particular group of new or reworked missiles were known to contain a component with a latent defect, they could be easily recalled. All the manager would have to do would be to determine where the particular serial numbers had been positioned and issue recall requests to the holding activities. At present, the only means to recall assets in the above category is to provide a listing of the defective unit serial numbers to <u>every</u> activity that might possibly hold them. Every activity then needs to take a physical asset count to see if they hold those particular assets. The likelihood of locating the assets in a reasonable time or even locating <u>all</u> of the items is extremely slight. It was reported that at one time it took in excess of three years to locate and recall 200 new SPARROW missiles which had been manufactured with a defective potientiometer. (Hannan, 1976).

As a final argument in favor of serialized tracking, a major logistic concern for missile assets is that of bringing assets back from the Fleet when they are due for mandatory maintenance. Three things are important in this regard. First, it is important for the manager to have a clear picture of the number of assets that will be coming back for maintenance so that he can arrange (fund) for the maintenance actions. One cannot assume that components sent out today will automatically be returned on their mandatory maintenance due date. There are other factors that determine when components are returned, such as deployed schedule changes and

failed units. Second, it is important for the using command to have a realistic picture of the status of the inventory their ships hold. Serialized tracking, coupled with maintenance due-date information could easily provide that picture. Third, the weapon stations and the depot repair facilities must be informed of the number of assets to expect so that provisions can be made for handling, testing and repair.

The disadvantage of serialized tracking would be that serial numbers would have to be listed on shipping documents, as well as listing quantities and types. This provides only little difficulty because, at present, missile component serial number information is available at the point of shipment, but not recorded because it is not a stated requirement. (DalPino, 1976). Recognizing that including serial numbers for missile component shipments is not especially difficult to implement, the reason for recording them deserves consideration.

D. SPECIFIC RECOMMENDATIONS (NAVY SYSTEM)

It is recognized that the Air Force is presently in the process of improving their ammunition management system. Therefore, because the basic performance of the Air Force system, while not optimum, rated well above that of the Navy, recommendations for corrective action will be directed only to improvement of the Navy system. It is recommended that:

--A physical count of high-value assets be made mandatory, at least annually.

--Results of the annual physical count be used to update the perpetual inventory and reasons for major variances stated explicitly.

--Annual physical counts be performed by agencies other than the ones maintaining the asset logs.

--A distinct separation be made between the accounting of high-value/major repairable assets and the routine supply replenishment function.

- --The feasibility of using a NAVAIR field activity as the central repository for high-value/major repairable assets be investigated.

- --The coupling of serial number tracking with maintenance due dates be instigated.

- --The condition coding of air-launched assets be reduced to only three categories--acceptable for issue, unserviceable, and unknown, i.e., A, F, and X.

- --Direct access remote terminals with cathode ray tube displays be installed at strategic locations, e.g., at all primary and secondary stock points to allow for real time input and output.

- --The Navy establish a full-time inventory manager at each strategic location and make that manager responsible for inventory accounting records and transactions at that activity.

- --The inventory accounting system for ALMs be made a separate and distinct system, i.e., separate it from CAIMS as we now know it.

Appendix G offers items to be considered in implementing the recommendations made above.

E. FURTHER RECOMMENDATION (INSTRUMENT VERIFICATION)

This thesis developed an instrument by which inventory accounting systems could be evaluated and that instrument was given its initial test in the authors' assessment of the two military and one commercial inventory accounting systems. It is recommended that the assessment instrument be further evaluated both by reassessment of the three systems included in this thesis and by test of other comparable inventory accounting systems.

INDEX TO THE APPENDIX

APPENDIX A

GLOSSARY OF ACRONYMS

AD&C . . . . Ammunition Distribution and Control Division

AFLC . . . . Air Force Logistics Command

AGM. . . . . Air-to-Ground Missile

AIM. . . . . Air Intercept Missile

ALC. . . . . Air Logistics Center

ALM. . . . . Air-Launched Missile

AUR. . . . . All-Up Round

AUTODIN. . . . . . Automatic Digital Network

BOM. . . . . Bill of Materials

CAIMS. . . . . . . Conventional Ammunition Integrated Management System

CECS . . . . Container Equipment Control System

CENO . . . . Central NOMIS Office

CINCLANTFLT. . . . Commander-in-Chief Atlantic Fleet

CINCPACFLT . . . . Commander-in-Chief Pacific Fleet

CNO. . . . . Chief of Naval Operations

DODIC. . . . . . . Department of Defense Identification Code

FMSAEG . . . . . . Fleet Missile Systems Analysis and Evaluation Group

GCG. . . . . Guidance and Control Sections or Group

IM . . . . Inventory Manager

IMA. . . . . Intermediate Maintenance Activity

INAS . . . . Industrial Naval Air Station

MASO . . . . Munition Accountable Supply Officer

MDCS . . . . Maintenance Data Collection System

MILSTRAP . . . . . Military Standard Reporting and Accounting Procedures

MILSTRIP . . . . . Military Standard Requisitioning and Issue Procedures

MMMU-1 . . . . . . Mobile Missile Maintenance Unit One

NAS. . . . . Naval Air Station

NAVAIREWORKFAC . . Naval Air Rework Facility

NAVAIRSYSCOM . . . Naval Air Systems Command

NAVSEASYSCOM . . . Naval Sea Systems Command

NMEF . . . . Naval Mine Engineering Facility

NOMIS. . . . . . . Naval Ordnance Management Information System

NSN. . . . . National Stock Number

PP&C . . . . Production Planning and Control Division

SISR . . . . Selected Item Status Report

SNUD . . . . Stock Number User Directory

SRAN . . . . Stock Record Account Number

SLIT . . . . Serial Lot Item Tracking

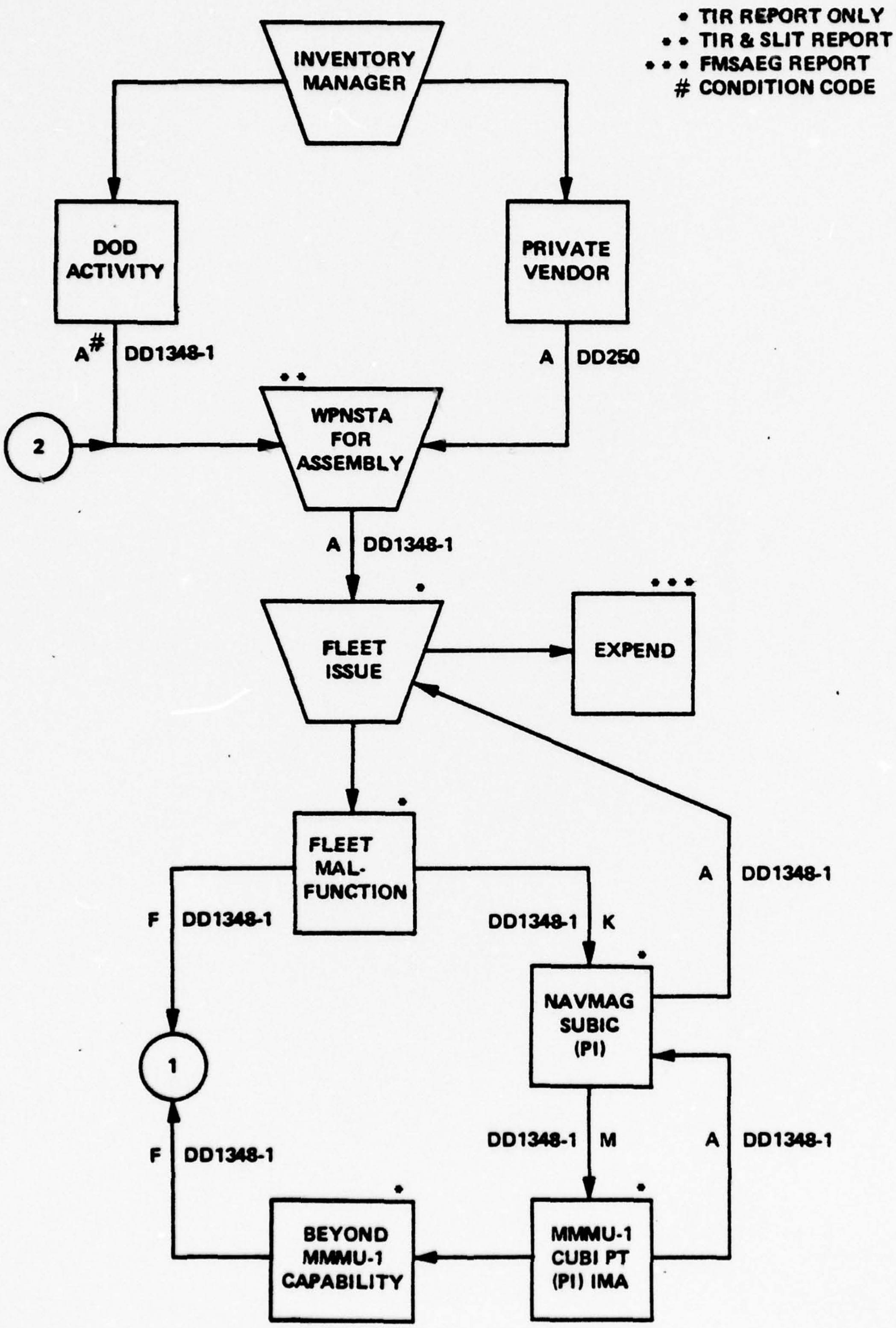
SPCC . . . . Navy Ships Parts Control Center

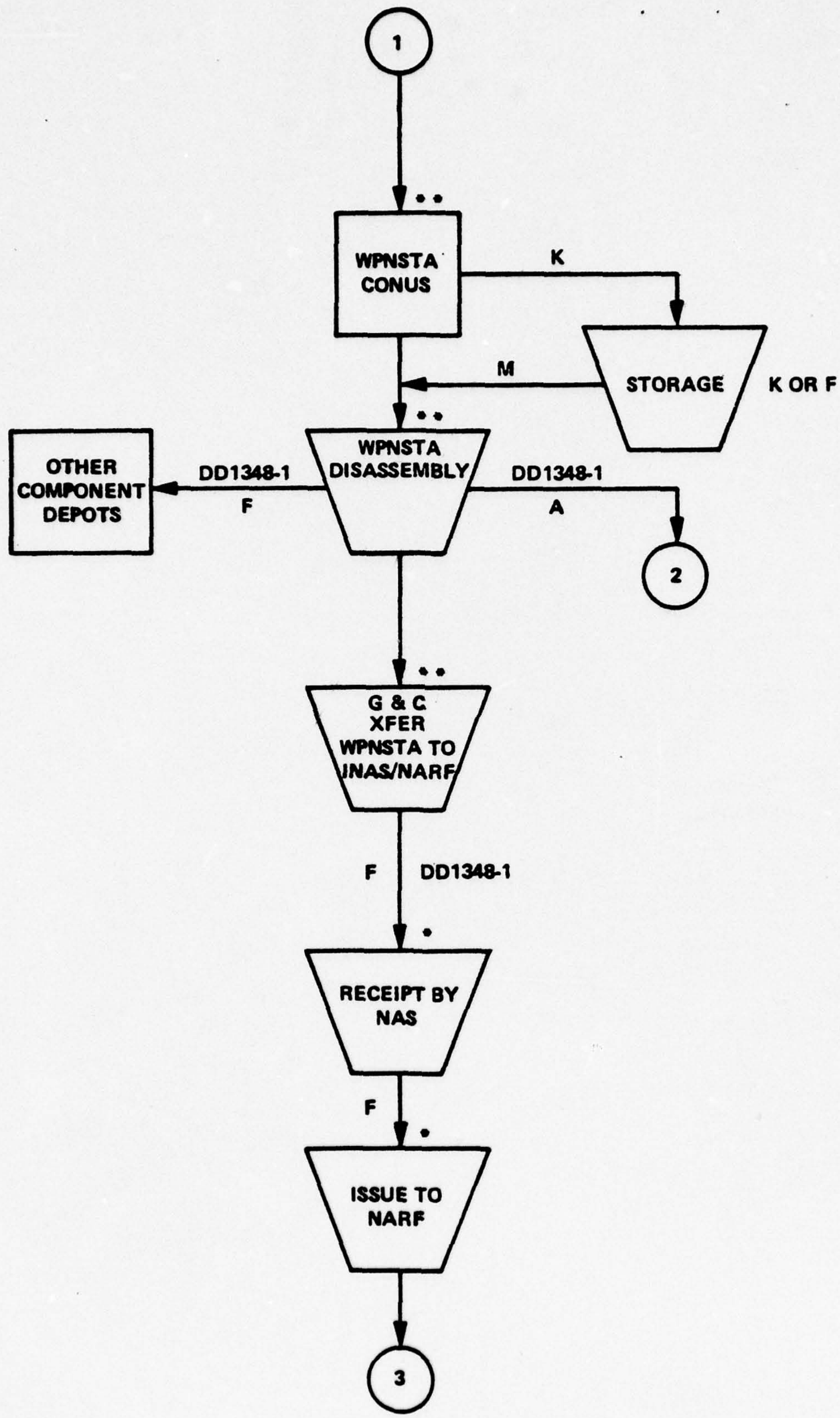
TIR. . . . . Transaction Item Reporting

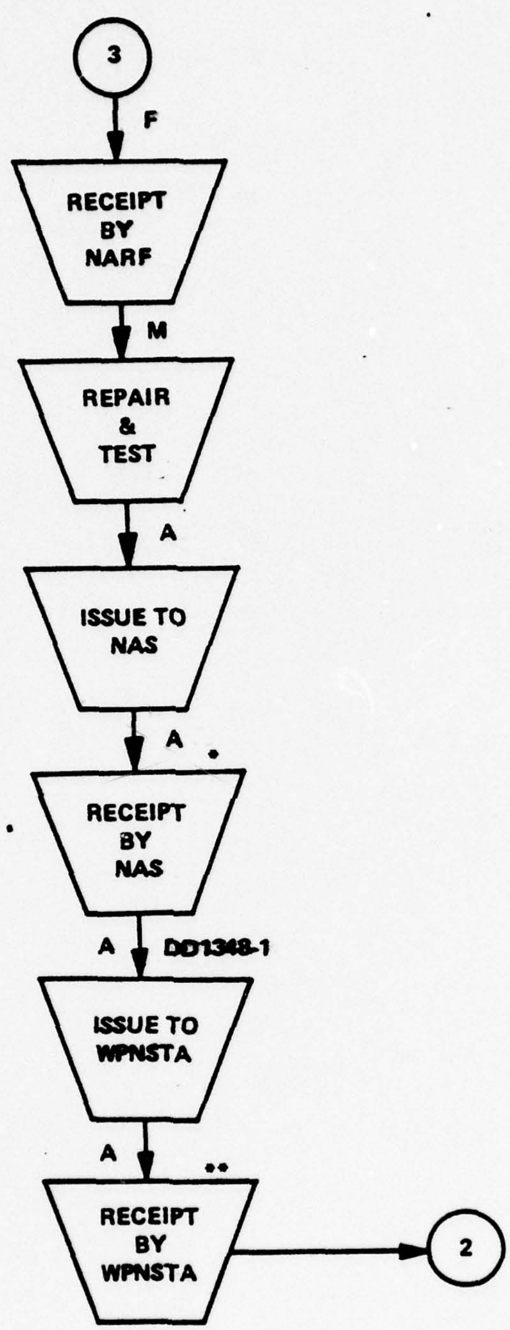
TYCOM. . . . . . . Type Commander

UADPS/SP . . . . . Uniform Automated Data Processing System for Stock Points

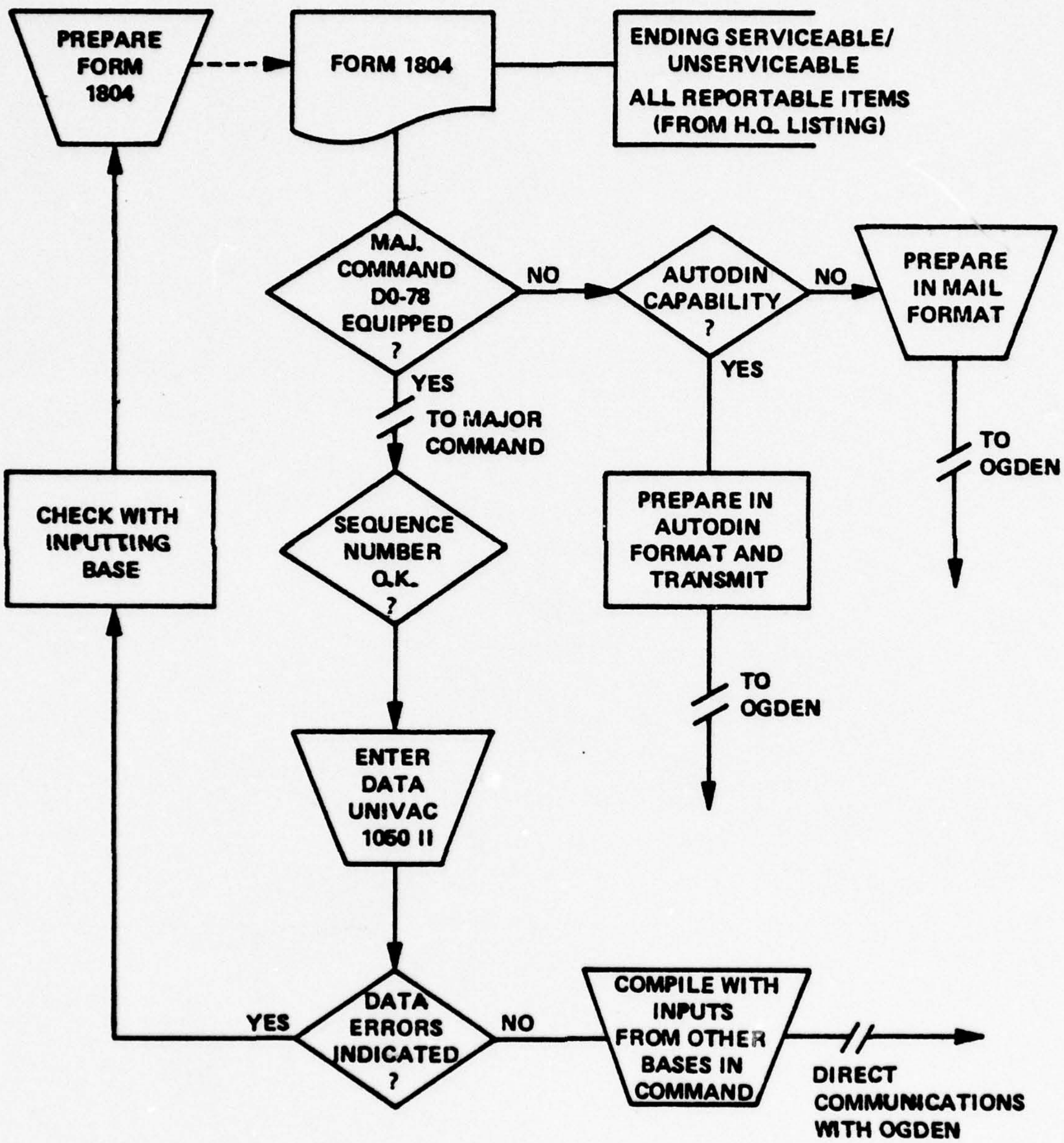
APPENDIX B
ALM FUNCTIONAL FLOW



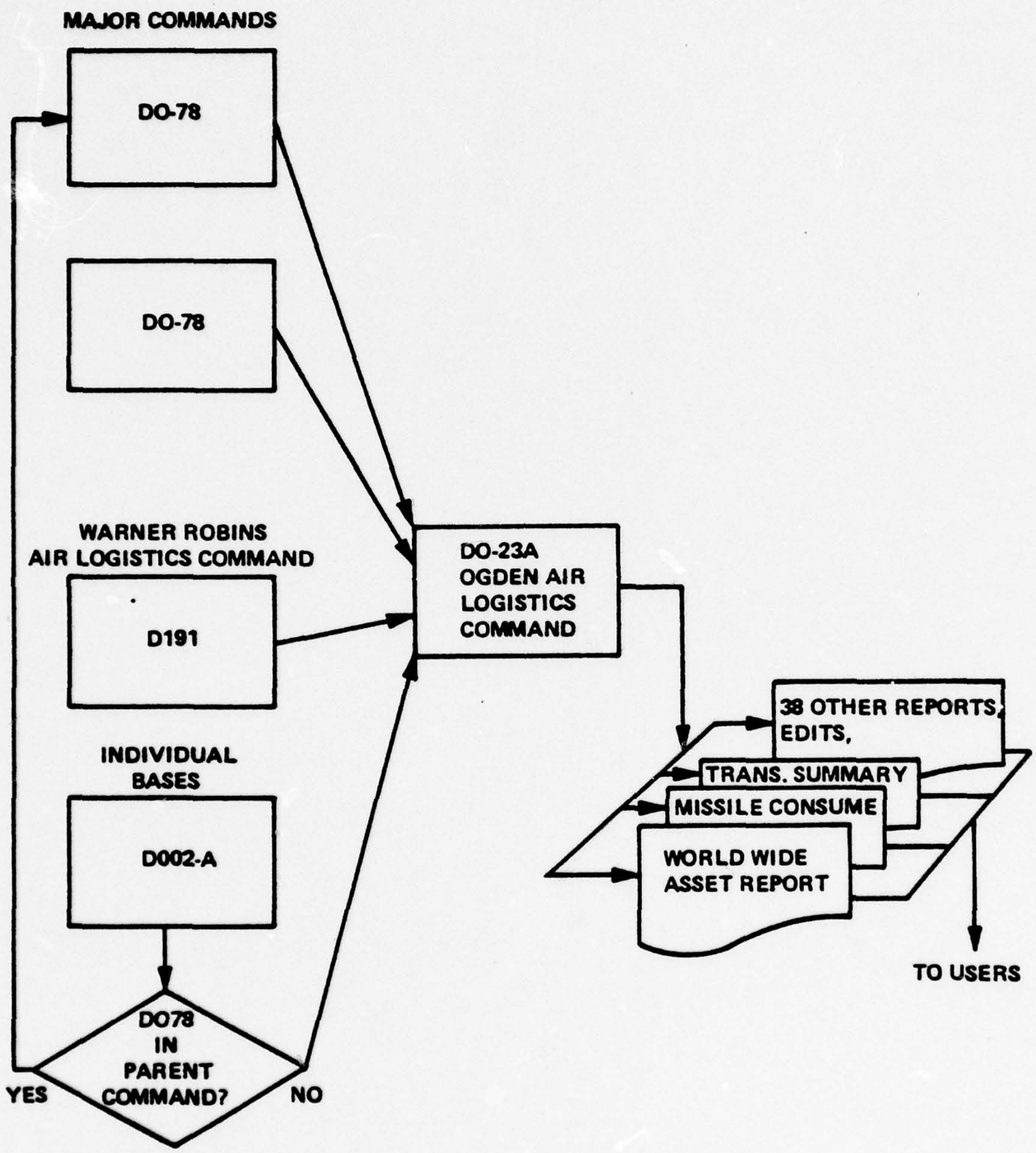

1
WPNSTA CONUS
K
STORAGE
K OR F
M
WPNSTA DISASSEMBLY
OTHER COMPONENT DEPOTS
DD1348-1
F
DD1348-1
A
2
G & C XFER WPNSTA TO NAS/NARF
F
DD1348-1
RECEIPT BY NAS
F
ISSUE TO NARF
3


3
F
RECEIPT BY NARF
M
REPAIR & TEST
A
ISSUE TO NAS
A
*
RECEIPT BY NAS
A
DD1348-1
ISSUE TO WPNSTA
A
**
RECEIPT BY WPNSTA
2

APPENDIX C U.S. AIR FORCE AMMUNITION MANAGEMENT SYSTEM

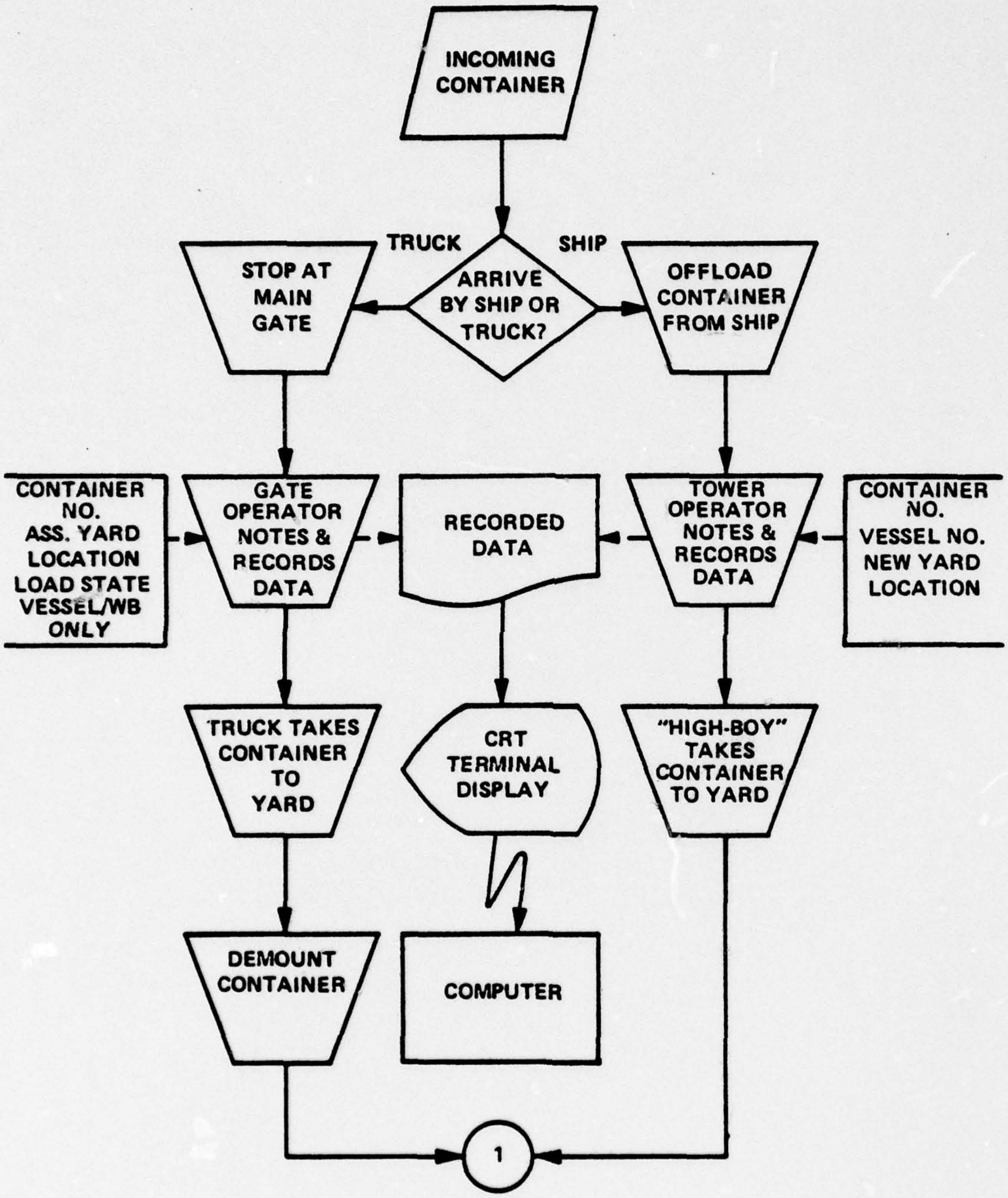


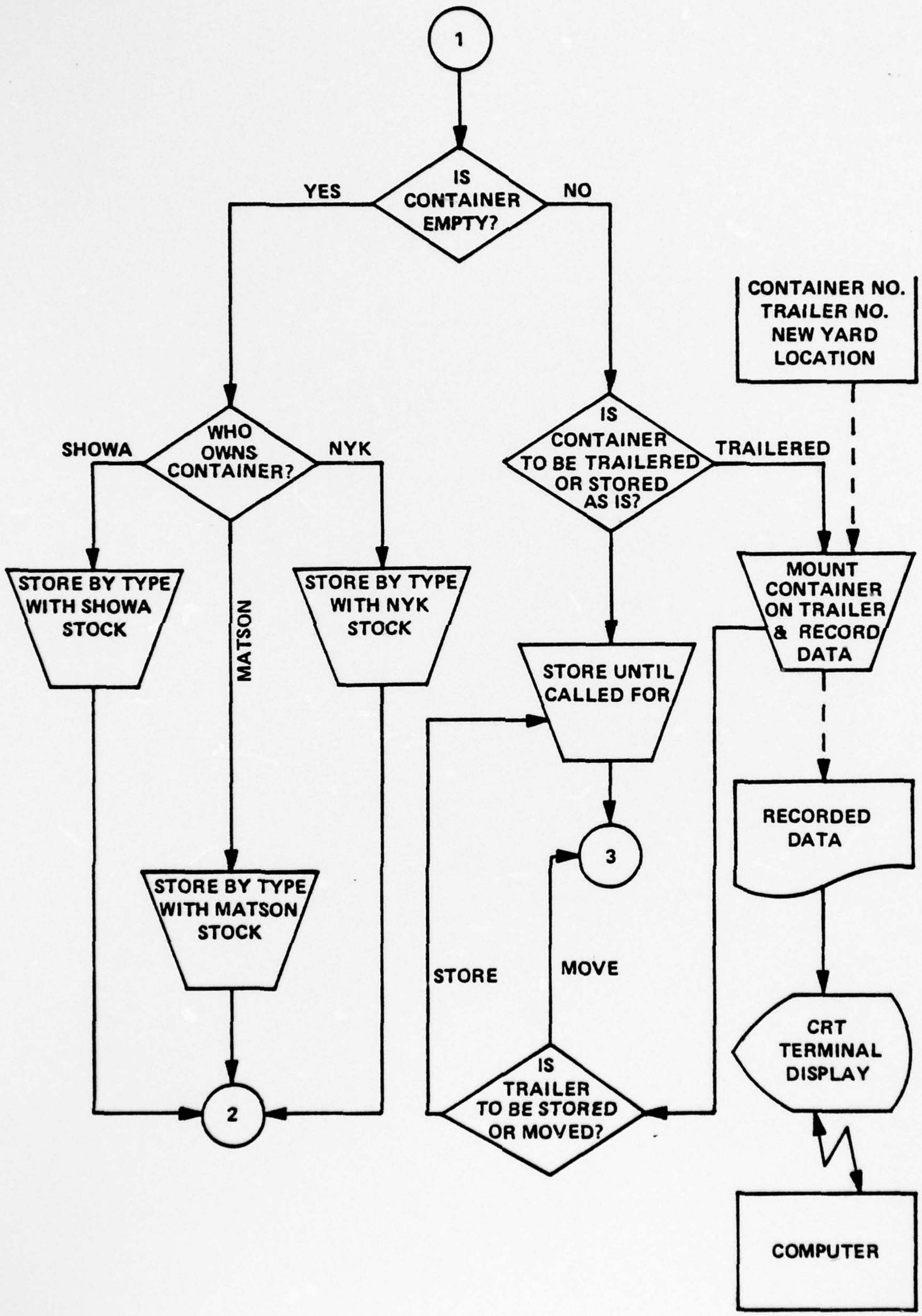
BASE AND FIELD COMMAND DATA PROCESSING

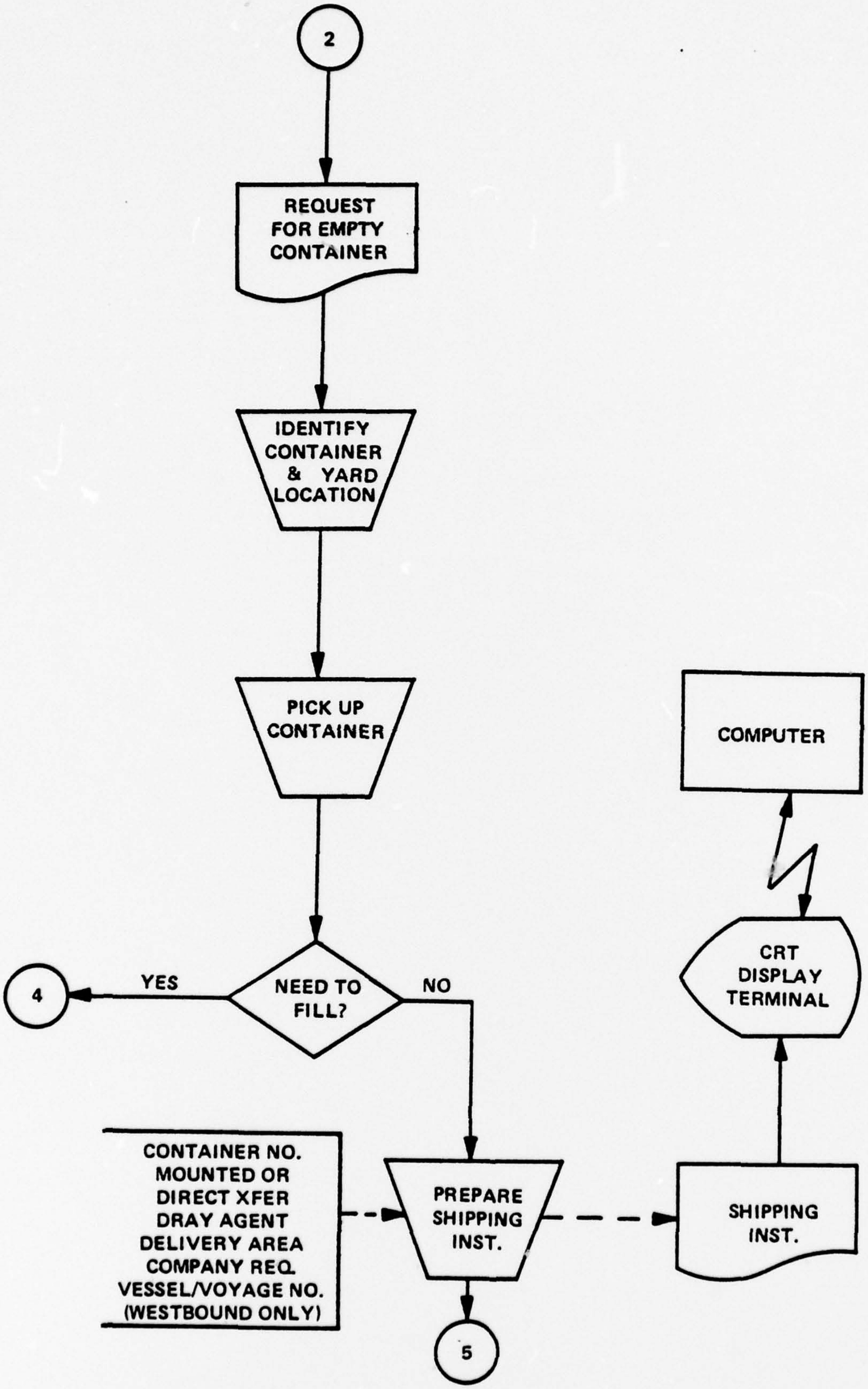


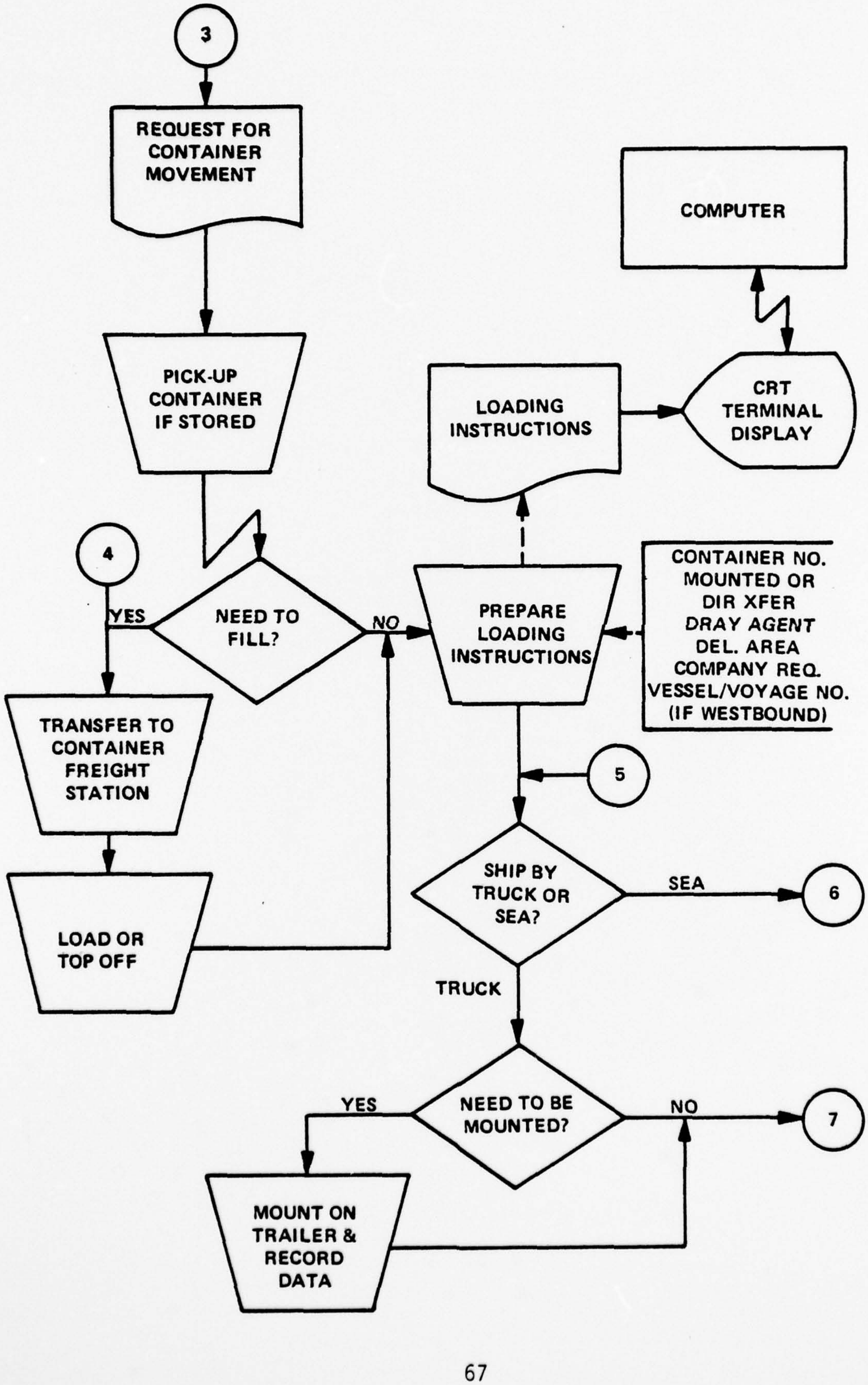
INTERCOMMAND
INFORMATION TRANSFER

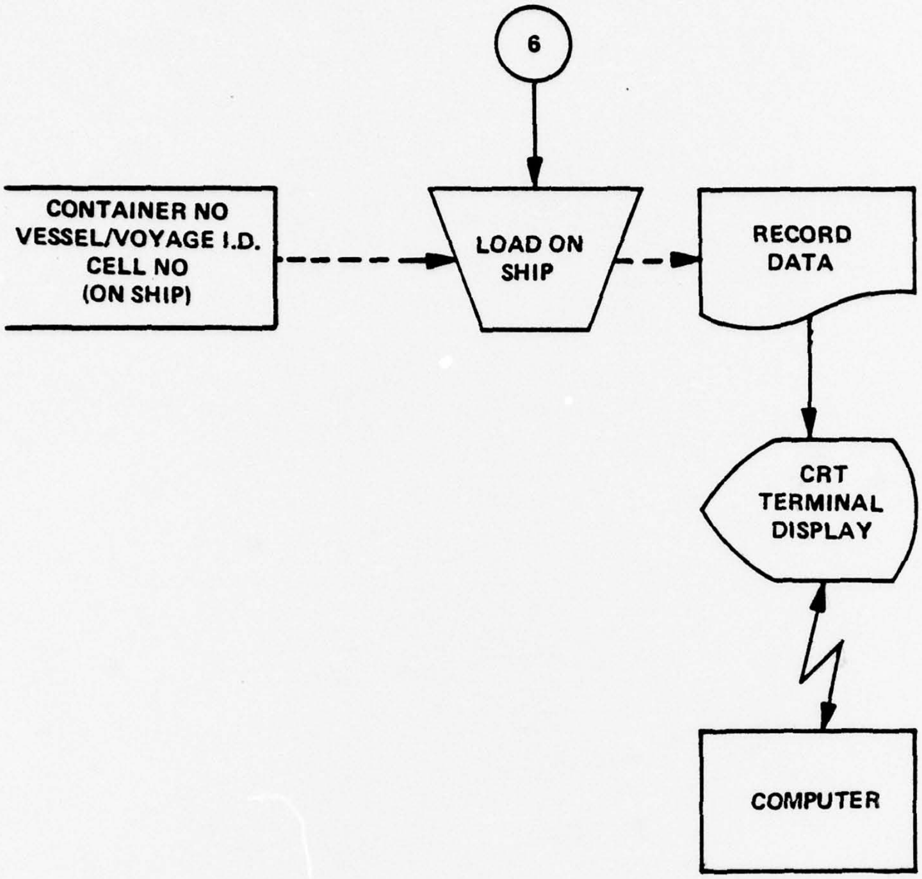
APPENDIX D. MATSON CONTAINER EQUIPMENT CONTROL SYSTEM

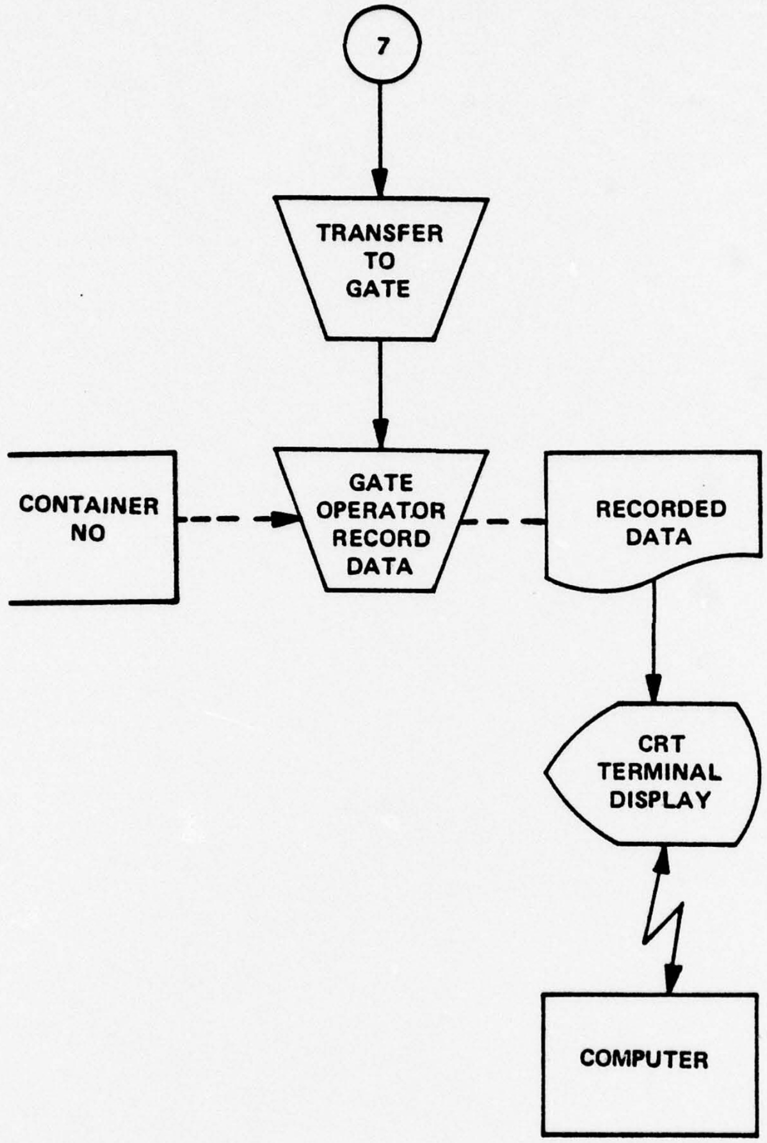



1
IS CONTAINER EMPTY?
YES
NO
WHO OWNS CONTAINER?
SHOWA
NYK
MATSON
STORE BY TYPE WITH SHOWA STOCK
STORE BY TYPE WITH NYK STOCK
STORE BY TYPE WITH MATSON STOCK
2
CONTAINER NO. TRAILER NO. NEW YARD LOCATION
IS CONTAINER TO BE TRAILERED OR STORED AS IS?
TRAILERED
MOUNT CONTAINER ON TRAILER & RECORD DATA
STORE UNTIL CALLED FOR
3
RECORDED DATA
STORE
MOVE
IS TRAILER TO BE STORED OR MOVED?
CRT TERMINAL DISPLAY
COMPUTER


2
REQUEST FOR EMPTY CONTAINER
IDENTIFY CONTAINER & YARD LOCATION
PICK UP CONTAINER
NEED TO FILL?
YES
4
NO
COMPUTER
CRT DISPLAY TERMINAL
CONTAINER NO.
MOUNTED OR
DIRECT XFER
DRAY AGENT
DELIVERY AREA
COMPANY REQ.
VESSEL/VOYAGE NO.
(WESTBOUND ONLY)
PREPARE SHIPPING INST.
SHIPPING INST.
5


3
REQUEST FOR CONTAINER MOVEMENT
COMPUTER
PICK-UP CONTAINER IF STORED
LOADING INSTRUCTIONS
CRT TERMINAL DISPLAY
4
YES
NEED TO FILL?
NO
PREPARE LOADING INSTRUCTIONS
CONTAINER NO.
MOUNTED OR
DIR XFER
DRAY AGENT
DEL. AREA
COMPANY REQ.
VESSEL/VOYAGE NO.
(IF WESTBOUND)
TRANSFER TO CONTAINER FREIGHT STATION
5
LOAD OR TOP OFF
SHIP BY TRUCK OR SEA?
SEA
6
TRUCK
NEED TO BE MOUNTED?
YES
NO
7
MOUNT ON TRAILER & RECORD DATA


6
CONTAINER NO
VESSEL/VOYAGE I.D.
CELL NO
(ON SHIP)
LOAD ON
SHIP
RECORD
DATA
CRT
TERMINAL
DISPLAY
COMPUTER


7
TRANSFER TO GATE
CONTAINER NO
GATE OPERATOR RECORD DATA
RECORDED DATA
CRT TERMINAL DISPLAY
COMPUTER

APPENDIX E

EXPLANATION OF ATTRIBUTE RATINGS

ATTRIBUTE	RATING			
	1	2	3	4
SIMPLICITY	INFORMATION INADEQUATE. EXTENSIVE INTERPRETATION NEEDED. EXTENSIVE TRAINING NEEDED TO UNDERSTAND INPUT AND OUTPUT. TOTALLY DEPENDENT.	INFORMATION FAIR. MODERATE INTERPRETATION NEEDED. MODERATE TRAINING NEEDED TO UNDERSTAND INPUT/OUTPUT. MODERATELY DEPENDENT.	INFORMATION MEETS BULK OF MANAGERS NEEDS. SOME INTERPRETATION NEEDED. INPUT/OUTPUT UNDERSTANDABLE WITH SOME EFFORT. INDEPENDENT	INFORMATION MEETS ALL OF MANAGERS NEEDS. INPUT/OUTPUT EASILY UNDERSTOOD; EASILY INTERPRETED. INDEPENDENT OF OTHER SYSTEMS.
ACCESSIBILITY	DIRECT INPUT LIMITED TO ONE LOCATION.	FEW STRATEGIC LOCATIONS ABLE TO MAKE & OBTAIN DIRECT INPUT/OUTPUT.	MOST STRATEGIC LOCATIONS ABLE TO MAKE AND OBTAIN DIRECT INPUT/OUTPUT.	DIRECT INPUT/OUTPUT MADE AND OBTAINED BY ALL STRATEGIC LOCATIONS.
TIMELINESS	NO INFORMATION AVAILABLE IN REAL TIME. EXTENSIVE INPUT DELAY.	LITTLE INFORMATION AVAILABLE IN REAL TIME.	MOST INFORMATION AVAILABLE IN REAL TIME. SOME INPUT DELAY.	ALL INFORMATION AVAILABLE IN REAL TIME MINIMUM INPUT DELAY.
ACCURACY	EXTENSIVE VARIANCE BETWEEN ACTUAL AND RECORDED DATA.	MODERATE VARIANCE BETWEEN ACTUAL AND RECORDED DATA.	SOME VARIANCE BETWEEN ACTUAL AND RECORDED DATA.	VIRTUALLY NO VARIANCE BETWEEN ACTUAL AND RECORDED DATA.

ATTRIBUTE	RATING			
	1	2	3	4
CONFIDENCE	ERRORS IN SYSTEM EXCEED MINIMUM ACCEPTABLE CRITERIA. NEVER TRUST SYSTEM	INFORMATION OUTPUT HAS MANY ERRORS. SELDOM TRUST SYSTEM.	INFORMATION ACCEPTED WITH SOME ERRORS. GENERALLY TRUST SYSTEM.	INFORMATION ACCEPTED AS BEING VIRTUALLY ERROR FREE. TOTAL TRUST IN SYSTEM.
COST EFFECTIVENESS	INFORMATION SO INADEQUATE THAT BUYING OF SPARES, NEW ITEMS, ETC, DONE BY GUESS WORK. OVER BUYING ALWAYS RESULTS.	INFORMATION PROVIDED CAUSES EXTENSIVE OVER OR UNDER BUYING OF SPARES, NEW ITEMS, ETC.	INFORMATION PROVIDED CAUSES SOME OVER OR UNDER BUYING OF SPARES, NEW PRODUCTION ITEMS, ETC.	SYSTEM ATTRACTIVE TO OTHER USERS. INFORMATION PROVIDED ALLOWS RESPONSIBLE PROCUREMENT OF SPARES, NEW PRODUCTION, WITHOUT FEAR OF OVER OR UNDER BUYING.
INPUT CONFIRMATION	SELDOM ACKNOWLEDGES RECEIPT OF INPUT.	OCCASIONALLY ACKNOWLEDGES RECEIPT OF INPUT.	OFTEN PROVIDES POSITIVE RESPONSE VERIFYING RECEIPT OF INPUT.	ALWAYS PROVIDES POSITIVE RESPONSE VERIFYING ACCURATE RECEIPT OF INPUT.
RECONCILIATION	NO ROUTINE PLANS EVER WRITTEN.	ROUTINE PLANS DEVELOPED. OCCASIONALLY USED.	ROUTINE PLANS DEVELOPED. OFTEN USED.	ROUTINE PLANS DEVELOPED. USED FAITHFULLY.

APPENDIX F

U.S. AIR FORCE AMMUNITION
MANAGEMENT SYSTEM INPUT FORMS

COMMENTS CARD

Field	Card Cols	Special Instructions
Stock record account number	1-5	
DODIC	6-9	
Remarks	11-64	Descriptive account of discrepancy.
Report number	65-70	
Sequence number	73	Consecutive number (1-9) of group
Card identifier	75	must be "R."
Transaction code	78-79	

END OF MONTH NOTIFICATION CARD

Description	Card Col	Special Instructions
Document identifier	1-3	Always 1EM
Reserved	4-8	
Reporting command code	9	Para 2*c*, atch K-7
Reserved	10-68	
Last report number	69-74	Para 2*j*, atch K-7
Reserved	75-80	

PREPOSITIONED MATERIEL RECEIPT CARD ENTRIES (OTHER THAN PROCUREMENT INSTRUMENT SOURCE)

Field Legend	Card Cols	Explanation and Instructions
Document Identifier	1-3	Enter "DWG."
Routing Identifier (TO)	4-6	Enter the code identifying the inventory control point to which the receipt will be reported ("FGS" or "FLZ").
Status	7	Leave blank.
Stock Number	8-22	Enter stock number of the item to be received.
Unit of Issue	23-24	Enter unit of issue of the item.
Quantity	25-29	Enter quantity to be received preceding significant digits with zeros.
Document Number	30-43	Enter the controlling MILSTRIP-type document number.
Suffix	44	Enter the controlling MILSTRIP suffix code; otherwise, leave blank.
Supplementary Address	45-50	Enter MILSTRIP supplementary address; otherwise, leave blank.
Signal	51	Enter signal code; otherwise, leave blank.
Fund	52-53	Enter fund code; otherwise, leave blank.
Distribution	54-56	Enter MILSTRIP distribution code; otherwise, leave blank.
Project	57-59	Enter MILSTRIP project code; otherwise, leave blank.
Multi-Use	60-66	Leave blank.
Routing Identifier	67-69	Enter code identifying storage activity which is to receive item.
Ownership	70	Enter "6."
Condition	71	Enter condition code of item to be received.

APPENDIX G

SUGGESTED STEPS FOR DEVELOPING A NAVAL AMMUNITION ACCOUNTING SYSTEM FOR HIGH-VALUE ASSETS WHICH REQUIRE PERIODIC AND UNSCHEDULED MAINTENANCE

The following steps are suggested for developing a new, high-value ammunition accounting system, and are made using the assumptions that:

--The system will be independent of other systems.
--The system will have direct access capability
--The system will provide serialized tracking.

A. ASSIGNMENT OF RESPONSIBILITY

It is essential that the responsibility for the system's design be assigned to one activity. It is suggested that the assignment be made to a Naval Air Systems command field activity with a strong background in management/data systems development.

B. TEAM DEVELOPMENT

Once the task of developing a new system has been assigned to a particular activity, the next step is to structure a working team to develop and implement the new system. The makeup of the team is critical. It would be expected that the team membership would change during the various phases of system implementation, and that the amount of involvement by individuals might vary depending upon what phase is in process. It would be expected that the activity whose responsibility it is to lead the effort would choose team members representing the views of:

--A program manager
--An inventory manager
--A weapon station logistician
--A rework activity
--A type commander
--A field weapons manager
--A supply system manager
--A data processor

C. SYSTEM REQUIREMENTS AND SYSTEM SPECIFICATION PREPARATION

One of the first tasks that would be expected of the team would be to determine the system requirements. In order to establish the system requirements, it would be expected that a detailed survey of the user's needs would be conducted. Results of the survey would be analyzed and the information used to write the system specifications. The system specification crystallizes and records the new system's complete structure, and becomes the central reference point for joint action by all involved in the project.

D. DETERMINATION OF STRATEGIC INPUT SOURCES

Once the specifications are written, the team must focus on strategic points where direct-access equipment is to be located. The choice of the locations must take into consideration such aspects as:

--Availability of communication lines (telephone)
--Need for secure lines
--Proximity to where the action to be reported takes place
--Requirements for reporting to other systems

E. DETERMINATION OF EQUIPMENT NEEDS

In this respect, two distinct areas of concern arise. First, the number of locations where inputs are to be made and outputs displayed must be established. It is anticipated that all remote terminals would have both input and display capability, but not all points where information is needed will be required to make inputs. Second, the type of equipment must be selected. This should be a direct function of:

--Type inputs anticipated
--Quantity of inputs/outputs anticipated
--Type outputs needed, i.e., visual CRT display or printed copy

It would be expected that the team would examine the data processing equipment presently in the Navy's inventory for possible use. In this

respect, it would be expected that assumption of "system independence" would be honored. This is not intended to require a separate computer, but rather to assure that the high-value asset accountability function is not commingled with other remotely related supply functions.

F. DEVELOPMENT OF A MECHANIZATION PROGRAM PLAN

After the preliminary fact-finding efforts are out of the way, the physical development of a new system can begin. Based on the user's needs, a program master plan should be prepared. The plan should include:

--Objectives
--Boundaries (cost constraints, security requirements and personnel limitations)
--Interfaces
--General hardware description
--Implementation schedules
--Activities involved
--Training plans and schedules
--General descriptions of the output products

G. SYSTEM MECHANIZATION

The system would be mechanized in accordance with the previously mentioned program master plan. Mechanization, of course, would include procurement, installation, test and evaluation. It would include the design and proof testing of the software as well as the procurement, installation and test of the hardware.

H. INPUT DATA GATHERING

The initial data needed to prime the system can come from only one source. That source is <u>not</u> the CAIMS. The source of new inventory data initially must come from a special one-time physical count because:

> The function of the physical counts under a perpetual inventory system is to check the accuracy of a record already in existence, not to supply for the first time information not to be found anywhere in the records. (Moonitz, Strehling, 1952).

Regardless of the inherent inaccuracy of the CAIMS data, the need for the initial physical count is actually justified by the mandatory requirement to record assets by serial number. That data cannot be obtained from CAIMS.

I. SYSTEM TEST

After adequate training has been provided, a period of trial should be used to establish confidence in the system. Periodic surveillance of the system's accuracy can easily be accomplished if the team (which would be required to establish basic system operation and maintenance policy) requires at least annual physical counts for the total system, and occasional random sampling of particular bases or activities.

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